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Technology, clustering and foreign investment

Sarianna M. Lundan

Sarianna M. Lundan
Associate Professor of International Business Strategy
University of Maastricht
Faculty of Economics and Business Administration
Department of Management Sciences
PO Box 616, 6200 MD Maastricht, The Netherlands
S.Lundan@mw.unimaas.nl
Tel: +31-43-388 3776
Fax: +31-43-388 4893

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Abstract

In this paper we will explore the consequences of the internationalization of corporate research and development (R&D) on the locational patterns of innovative activity, and the role foreign investment plays in the financing of such activity. We know that although the number of research-intensive small firms continues to grow, both in terms of output as measured by patent citations as well as input as measured by R & D expenditures, large firms claim the lion's share of innovative activity in many sectors, although sectoral differences are substantial. Additionally, the share of government funded research has continuously declined in the aftermath of the cold war, while corporate investment in research and development has become by far the most important source of research financing within the G-8 countries, with the exception of Italy. At the same time, the key aspect of the transformation of the multinational firm over the past decade has been the changing of focus away from the exploitation of home-based capabilities towards the establishment of corporate networks aimed not only at the diffusion, but also at the exploitation of disparate knowledge-based resources. Thus multinationals have a unique capability of combining both sources of funding and sources of innovation into the successful commercial introduction of new innovations. We argue, that the source of the available cash flow in the case of the largest multinationals is at least partly attributable to market power and market domination, as only firms that can rely on a brand name, superior distribution, and in final consumer markets, extensive advertising, can generate the required cash to run a successful R & D program. In the final part of this paper, we will present some aggregate evidence on the patters of innovative activity within Europe, paying particular attention to the role of retained earnings in the financing of American direct investment in European research and development activities.

Key words: Multinationals, research and development, clustering, foreign investment, retained earnings

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Introduction

In this paper we will explore the consequences of the internationalization of corporate research and development (R&D) on the locational patterns of innovative activity, and the role foreign investment plays in the financing of such activity. The process of innovation has been characterized as a coupling activity by comparing it to a pair of scissors, with demand-pull representing one blade and innovation-push representing the other blade.[1] We employ this metaphor in a slightly different form to represent the process of industrial innovation as the coupling of innovative ideas on one side, and financing and marketing capability on the other side. While we are not suggesting that this approach is particularly novel, it allows us to discuss the two essential aspects of the innovation process that make the role of multinational enterprises (MNEs) in this process a critical one.

We know from existing research that innovations are concentrated within large firms, and that although the number of research-intensive small firms continues to grow, both in terms of output as measured by patent citations as well as input as measured by R & D expenditures, large firms claim the lion's share of innovative activity in many sectors, although sectoral differences are substantial (Freeman & Soete, 1997). It should also been noted, that in the United States, the share of Federally funded research has continuously declined in the aftermath of the cold war, while corporate investment in research and development has become by far the most important source of research financing. In fact, this is the case in all of the G-8 countries, with the exception of Italy, where industry provides research funding for 44%, while government funded research accounts for slightly over a half of the total (National Science Board, 2002 4-48).

To address the issue of where do innovative ideas come from, since they are not a simple function of R&D efforts, we need to look at the institutional influences on innovative activity. To

describe such institutions on the national level, the literature on national systems of innovation helps us to identify the central features, such as programs of technical and vocational education, levels of university education, public funding of R&D, and the existence of public research institutions (Nelson, 1993b). However, as useful as this literature is in order to appreciate the variety of institutional systems in existence, an approach concentrating solely on the national level almost inevitably results in an equal number of systems as countries (cf.Amable, 2000), so in order to overcome this problem we propose to dis-aggregate the discussion to the level of the firm

At the lowest level of aggregation, individual entrepreneurs, due to their tolerance of risk and ambiguity, create markets by bringing together previously disparate segments of the economy. Consequently, differences in the rates of entrepreneurship across borders are one part of explaining differences in innovative activity. However, since we are concerned specifically with the marriage between sustained financing and innovative activity, we will focus on the role of multinational firms in exploiting the innovative capabilities available in local clusters of activity. Indeed, the key aspect of the transformation of the multinational firm over the past decade has been the changing of focus away from the exploitation of home-based capabilities towards the establishment of corporate networks aimed not only at the diffusion, but also at the exploitation of disparate knowledge-based resources. We will argue that multinationals have a unique capability of combining both sources of funding and sources of innovation into the successful commercial introduction of new innovations.

The superior financial resources of multinational firms may be path-dependent, in other words, they may rest on a past inheritance, but for most multinationals global competition entails mandated re-investment (Milberg & Gray, 1992), i.e. the generation of sufficient cash flow to feed competitive levels of R&D on a sustainable basis. The source of this cash flow at least in the

case of some of the largest multinationals is undoubtedly partly attributable to market power and market domination, as only firms that can rely on a brand name, superior distribution, and in final consumer markets, extensive advertising, can generate the required cash to run a successful R & D program. But having the resources to invest in R&D, and in particular to invest in the commercialization of innovation, does not guarantee a regular source of inventions. We will argue that the ability of the multinational not only to exploit its market power, but also its superior access to knowledge-based resources around the world gives MNEs a key place in the generation of new technology. We will also present some aggregate evidence on the patters of innovative activity within Europe, and particularly on the extent of American direct investment in European research and development.

From a policy perspective, facilitating the ability of the multinational to attach itself to local innovative networks requires a policy of non-discrimination towards foreign investors, and results in an exacerbation of differences between regions. Thus while the competitive clusters develop at the regional (sub-national) level, any efforts to reduce the effects of regional disparities are more likely to occur at the supranational (EU) level. Since locational competition is to an extent unavoidable, we will argue that policy efforts should focus on encouraging regions to invest in revealing their true competences in order to avoid market distortion as a result of misdirected investment.

Knowledge and location

The literature on so-called national systems of innovation has produced some interesting research on the connections between firms and the local national and regional institutions that support them, such as independent research centers, universities and the like (see e.g. Nelson (1993a;1993b) on the national level and Cooke and Morgan (1998) on the regional level). A well-functioning network of firms and institutions not only encourages domestic economic activity,

but also creates an attractive hotspot for foreign multinationals, eager to benefit from the interaction.[2] However, the same virtuous cycle of the right institutional climate attracting the right kind of firms that makes the region even more attractive, also risks locking the region into a particular trajectory of growth. In a sense, the lack of variety of options available to the generalist is the price one pays for increased specialization. More specialized resources are also more unique, which makes investing in them both a high risk and high return type of activity.

In a recent special issue of *Industrial and Corporate Change* on the geography of innovation and economic clustering, the editors point to a couple of interesting lessons learnt from the literature so far (Breschi & Malerba, 2001). First of all, there seems to be a wide consensus, that the availability of a highly-skilled labor force, and the quality of the human capital coming from leading universities is likely to be one of the most important factors encouraging the growth of innovative clusters. Another point of commonality is, that there is clearly a difference in trying to understand the dynamics of well-established clusters like Silicon Valley, and understanding the dynamic growth of emerging clusters. Nonetheless, the importance of external linkages appears to be important both for emerging and established clusters, and of particular interest to us here is how such linkages are established. While linkages can result from the repatriation of foreign educated engineers and scientists, or the movements of key scientists within a firm or between firms, we are particularly interested in the extent to which multinational corporations initiate the establishment of such linkages in distant clusters of innovation.

Not surprisingly, on the public policy front, the editors conclude that there is indeed a consensus for policy to be in the first instance broadly supporting of the infrastructure of innovation. This means primarily investment in education, while more directed programs such as the establishment of science parks and various kinds of technopolis, are not likely to be very successful. With the government playing a supporting role, and we would argue with

multinationals playing a facilitating role, it would appear that the more 'organically' grown clusters such as the case of Baden-Württemberg (Cooke, 2001), where the interactions involve both public and private sectors, appear to be more successful. In another example, in the development of a new high technology region around Washington DC (Feldman, 2001), entrepreneurial activity in response to external shocks set in motion the beginnings of the development of a cluster. While government policy was broadly supportive, it followed the establishment of a proto-cluster rather than bringing it about in the first place.

If clustering is fundamentally an issue of employment, and the right kind of human resources in the right place at the right time, it is also an inherently local phenomenon, particularly in Europe, where the labor mobility of highly-skilled labor is very low. This is partly due to institutional impediments that still remain after the creation of the common market, for example in the lack of mutual recognition of professional qualifications for doctors and lawyers, and the difficulty of transferring pension rights across borders. But it is also because the idea of a Europe-wide labor market has not yet featured in any meaningful way in the minds and career paths of professionals. Thus the highly trained resources that lie at the heart of clusters are relativity immobile, and require than in one form or another, economic activity is drawn to them rather than the other way around.

Furthermore, if at the heart of knowledge creation lies a system of education and specialized human resources, the question is raised as to what extent is this an extension of agglomeration or urban economies, or to what extent does it rely on the existence of knowledge spillovers. Breschi and Lissoni (2001) tackle this question in an interesting paper, where they argue, that what would have been labeled as spillovers in the innovation literature, are not necessarily spillovers of the technical variety, but should perhaps more appropriately be classified as pecuniary externalities of the Marshall type.[3] Such externalities arise because of the increasing

availability of specialized skilled labor and specialized suppliers in a given area allows local firms to become more efficient, and it might also allow firms to charge higher prices in the market. Such externalities are pecuniary, as they are experienced either through the price mechanism or the labor market in wage costs. Non-pecuniary externalities, on the other hand, are the result of a genuine spilling over of knowledge, which is of course much harder to quantify, but which may nonetheless have suffered somewhat from an over-attribution in the recent literature. We agree with Krugman (1991), that before trying to use pure technological externalities in out explanations, it would be useful to see how far the story could be told by reference to pecuniary externalities, that lend themselves more easily to measurement.

In other words, while there is no question that innovative activity is spatially concentrated, to what extent do actual knowledge spillovers account for much or any of the concentration is an open question. Part of the problem here is that knowledge spillovers are difficult to define in a way that would not lead to contradictory conjectures. In other words, if the essence of a spillover is that knowledge is a public good, with the characteristics of non-excludability and non rivalry, such spillovers should be equally appropriated by all firms with the capacity to utilize such information. However this in itself doesn't dictate whether the receiving firms would be near or far. One contention is that such knowledge would only spill over in close proximity, i.e. with the possibility of face-to-face contact. In this connection, many authors make the distinction between knowledge that includes a tacit component, and is difficult to transmit, and information that is codified, and easier to transmit over distances. However, the distinction between tacit versus codified knowledge doesn't really help to address the issue of why in practice, knowledge seems to be simultaneously both difficult and easy to transmit. Thus, for example, there is a great deal of research studying knowledge management within multinational firms, or the ability of the firm to transfer knowledge, some tacit and some codified, within the

firm. At the same time, there is a great deal of research directed at inadvertent spillovers of knowledge, particularly within collaborative ventures between firms.

An alternative way of looking at the flow of knowledge is to change the focus away from the amorphous knowledge and its inherent properties, and instead to look at the institutional context within which the knowledge transfer occurs. Breschi and Lissoni (2001) suggest by reference to some recent literature, that it is possible that contractual activity underlies much of the transfer of knowledge within high-technology clusters, particularly in connection with University research, or that at the very minimum, the institutional context within which the transfer takes place is essential in determining the extent to which knowledge spills over, or is carried over on purpose.

We will argue here, that the participation of firms within networks of local firms and institutions is in itself an effort to appropriate a part of the market, and it is in a way similar to the participation of firms in business groups and associations. Each association develops its own norms and language to promote the objectives of its members, and it is possible that, as suggested by Breschi and Lissoni (2001), that such conventions also extend to the transfer of knowledge within high-technology clusters. Rather than being a product of the inherent characteristics of knowledge, successful transfer is the outcome of a process of exclusion. To effect such exclusion, it is possible that scientists and other groups of practitioners develop their own jargon which at the same time is highly specific and specialized, and yet dependent on the context within which it is transmitted in order for it to be deciphered correctly.

But exclusion can also take much more mundane forms, such as a reciprocal obligations for exchanging information and norms about sharing within the group, and correspondingly not sharing outside of the group. Such a system can function on trust and mutual forbearance, or like any successful cartel, it can also function on mutual monitoring and effective punishment of

defectors. Either way, the knowledge that is transmitted doesn't really spill over like a true public good, but it is shared more like common property or a club good. This implies that the goal of knowledge management is perhaps partly how to prevent the accidental spilling of knowledge, but at least as importantly, it is about how to be included within the clubs that are sharing knowledge. For example, the success of new clusters described in Bresnahan, Gambardella and Saxenian (2001) was strongly influenced by specializing in a niche underserved by leading firms, but linked to the activities of US firms (India, Israel, Ireland and Taiwan), or in the Scandinavian case, by the establishment (and eventual success) of the GSM standard, which 'created' the market. (See also Teece (1992) for a classic argument about the importance of a dominant design.)

The influence of organized social contact through industry associations, research consortia and such also tend to reinforce the basic finding that systems of innovation are sectoral with similarities within industries and across borders (Breschi, 1999;Malerba, 2002). Malerba's (2002) suggestion that the appropriate units of analysis are not firms, but individuals, or units of firms (or indeed groups of firms) suggests that the inclusionary or exclusionary effect of clubs should play a role in the study of industrial innovation. In a way, trust relationships and group culture are just a means of defining the inside and outside. In some cases, the exclusion is not absolute, as an outside firm taking on the behaviors and characteristics of a local firm can eventually be accepted within the network. On the other hand, monitoring and punishment systems also likely to work much more effectively when the actors within the club are well known. A very interesting example of institutionalizing such inclusion (and exclusion) is provided by Cooke (2001), who describes the emergence of private clusters or EcoNets in Silicon Valley. These are groups of start-up firms, set up by venture capitalists like Kleiner Perkins, who

manage them in keiretsu-like manner, with a strong sense of an inside and outside group of firms.[4]

Knowledge-based resources and MNEs

Evidence of the importance of foreign sourcing of competitive assets by Fortune 500 multinationals, particularly in high technology sectors, has been presented by a number of authors, including survey-based evidence by Dunning et al. (Dunning & Lundan, 1998;Dunning & Wymbs, 1999). They argue, that in addition to size and consequent oligopolistic rents resulting from market domination, one element contributing to the advantage of multinationality is the ability of multinationals to source various competitive resources around the world. In particular, the recent decades have witnessed a tremendous increase in various cooperative efforts by firms in order to gain access to various geographically dispersed resources. However, the patterns of partnering activity present a picture of concentration, both in terms of a sectoral concentration in high technology, as well as a geographical concentration within the Triad. While in the earlier stages of internationalization, the tendency was for firms to keep their R&D related activities closer to home, the increased partnering activity is an outgrowth of the internationalization of the R&D function, which has also resulted in the establishment of corporate R&D centers abroad (Lundan & Hagedoorn, 2001).

The underlying reasons for the expansion of cross-border cooperative activity are related to intensified global competition and the consequent shortening of product life cycles, and the need to keep the costs of new product development under control by collaborating with other firms. Thus, a firm may hope to partner in order to gain experience in a field where its current competencies are minimal, and where in-house development would be exceedingly expensive and time-consuming. On the other hand, a firm might wish to access the locally developed

resources as an intact package, and the dramatic increase in mergers and acquisitions in recent years can be at least partially attributed to this desire.

Hagedoorn and Lundan (2001) present evidence of partnering activity since the 1980s, and argue that there is clear shift, whereby companies seem to prefer contractual partnerships to joint ventures, and there is an explosion in high-technology partnerships. However, such trends mask a great deal of inter-industry variation, since the information technology and chemicals sectors alone account for slightly under and slightly over a half of all new alliances in the high and medium technology sectors respectively. It should also be noted, that over the past ten years the vast majority of alliances in the two most active sectors, namely information technology and biotechnology, have been alliances between American firms. In fact intra-American alliances have been twice as numerous as the second largest group, which are alliances between American and European firms (National Science Board, 2002 4-40).

There is therefore an increased interest on the part of multinational to access different elements of the local network of institutions in their host locations, and to combine such elements within the multinational network of the firm. Recent research on knowledge management within MNEs has indicated, that efforts to link the subsidiaries to the local institutional structure, and in particular to the system of innovation, promotes learning within the subsidiary, and to the extent that knowledge is transmitted within the MNE, this makes the subsidiary more secure within the MNE network (Simoes, Biscaya, & Nevado, 2002). In some cases, such subsidiaries can grow to form the basis for a center of excellence within the multinational network (Holm & Pedersen, 2000).

The evidence on the influence of multinational corporations on the further development of regional clusters has been explored extensively by Cantwell and his colleagues (Cantwell & Iammarino, 2001;Cantwell & Noonan, 2001). In their research using U.S. patent statistics as

indicators of innovative activity, they have charted the role of multinational firms in the leading innovative clusters within Europe. Their results reveal, that depending on the industrial sector, multinational sometimes attach themselves to existing local centers of excellence, while in other instances there is a complementarity between the firms existing skills and those prevalent in the location. In general, multinationals appear to be more technologically diversified than the regions they enter into. (Only three of the 33 EU regions studied by Cantwell and Iammarino (2001) experienced a broadening of technological specialization over time.)

The fact that in the science-based sectors, corporate research seems to be strongly concentrated in the domestic market (Cantwell & Santangelo, 2000) may be an indication of the tacitness of the underlying knowledge and the consequent need for face-to-face communication. Alternatively, it can also be seen as an indication of the exclusion of foreign firms from existing groupings and knowledge sharing communities. The assumption there would be, that it is easier in the first instance to form clubs with local firms of the same nationality, and that some clubs can perpetuate themselves for quite a while, if there is sufficient critical mass to sustain the innovative activity without the intrusion of foreigners. Of course, in this sense the question of investment in high-technology sectors is quite different from market-seeking or resource-seeking investment, because in the first case, this is a question of what motivates the multinational in the search for foreign locations, while in the case of high-technology industries, it is also a question of which locations would be both better suited, and willing to receive such investment, keeping in mind that the costs and potential long-term implications of a wrong decision are quite substantial.

In terms of attracting a multinational into a local cluster, a high quality infrastructure is necessary, but not sufficient in ensuring that from among many potential investors, the investor with the best long-term potential will undertake the investment. But even if the right firm is attracted, without a degree of exclusivity arising from membership in the local network, the

means governments have of tying the multinational into the local network amount to little more than moral persuasion. We would argue that rather than offer monetary incentives, the host government can play an important role in facilitating the entry of the foreign investor into the local network, including research consortia and other collaborative ventures involving local firms. This contrasts with the overall provision of high-quality infrastructure in terms of a highly educated work force, for example, in that there should be asymmetrical benefits accruing to the firm that enters early into the network. The more fully the multinational participates in the local network, the more it is in its interest to keep the network functional and exclusionary, which in the long run should result in the kind of value-adding collaboration governments are hoping to achieve.

MNEs and 'mandated re-investment'

In spite of the extensive literature devoted to high technology investment, clustering and alliances, very little as been written on the origins the funding for R&D investment. For most multinationals, global competition entails mandated re-investment (Milberg & Gray, 1992), i.e. the generation of sufficient cash flow to feed competitive levels of R&D on a sustainable basis. We would argue here, that the critical ability of a multinational to combine financial resources with geographical reach is made possible by combining the multinational's ability to derive profits based on higher prices and lower wages (market power), and to reapply these in sectors where innovative or entrepreneurial profit can be generated.[5] We agree with Cantwell and Santangelo (2000), that in principle, unlike standard profits, which are based on market power, and tend to shift income from wages to profits, entrepreneurial profits are at least compatible with increasing wages, albeit linked to productivity and an increase in profits, and are in that sense preferable to profit derived from market power. The point we are making here, is to question whether the latter kind of profit is possible without financing from the first kind.

Entrepreneurial profits are clearly preferable if innovation is thought to be a positive sum game, resulting in improvements in the processes of production and the introduction of new products. But of course there is no guarantee that all innovative activity is genuinely productivity enhancing. In extremely competitive markets, multiple simultaneous efforts to achieve the same result can easily take place, and assessing whether this is a case of 'healthy variety' or 'wasteful duplication' is a difficult distinction to make. Furthermore, since the ability to market and distribute products effectively is crucial in the process of appropriating returns from innovation, superior financial resources can lead to the market adoption of a technically inferior product. While virtue may be its own reward, if innovative activity doesn't result in improved productivity or entirely new products, the origin of the profit remains suspect.

It is suggested here, that there is a tradeoff between the two kinds of profit, where continued innovation is paid for to an extent by increasing market power. Of course, a virtue of international production is that the payers and the beneficiaries do not have to be in the same markets, since profits derived from elsewhere or from different activities can be used to finance innovative activities in another location. We also agree with Cantwell and Santangelo (2000), that increased competition in many markets has set definite limits to the ability of multinationals to derive profits based on market power, and that part of the spur to innovative activities is the need to find new sources of profit. However, at the same time we wonder what proportion of such profits are a by-product of spurious (marketing) innovation and market power as discussed earlier.

There are of course other issues in the financing of high technology investment, particularly regarding the existence of so-called funding gaps in the financing of small high technology firms.[6] While the argument can be made that intrapreneurship within large firms can overcome the information asymmetry and consequent adverse selection related to risky projects,

lending criteria can also become distorted through internal interference and politics. More broadly, any form of relationship lending, where the lender is in a long-term relationship with the innovative firm, can improve the functioning of the market. For example, Cooke (2001) emphasized how the German-style regional credit based system, which is an institutionalized form of relationship lending, can be very valuable for startup firms, particularly if the private sector is not very keen on risk-taking.

Investing in innovation

A problem with much of the empirical research on the geography of innovation is that while the central ingredient identified in nearly every study as critical to the process, namely the locally specialized human resources, are immobile and location specific, the means used to measure the extent to which local and foreign firms exploit these locational resources is disconnected from location to various degrees. The literature that looks at innovation counts and the influence of university-industry spillovers is by its nature more locationally specific, and has a moved to progressively lower levels of aggregation, from the level of the nation or state to regions and sub-regions. However, the extensive research that looks at patenting as the outcome of innovative activity, or the literature that looks at alliance formation as a proxy for innovative activity, suffers from the problem of not being able to link the general outcome to the local context. This is not to say that the focus on patenting wouldn't be important in the sense that that they are ultimately related to firm profitability. But from the point of view of the location hosting the innovative activity, while patents (or alliances) contribute to corporate success, they are not necessarily indicative of the money being spent on research and development and more specifically, on employing research scientists in a particular region.

In this connection, we would like to highlight a few specific aspects of the extent of R&D activities of US multinationals in Europe. These data are drawn from the 1994 benchmark survey

of U.S. direct investment abroad conducted by the Bureau of Economic Analysis, and they represent the most recent comprehensive data on the activities of majority-owned foreign affiliates of US firms.[7] These data reveal that of the $11.88 billion worth of research and development performed by foreign affiliates, 73% was performed in Europe, and within Europe 78% of this money was spent in only four countries, namely Germany, United Kingdom, France and the Netherlands. Furthermore, 58% of the investment was concentrated in only three sectors: pharmaceuticals, computers and automotive investment.

By contrast, the latest available figures for the R&D activities of US affiliates of foreign firms come from the preliminary results of the 1997 benchmark survey of foreign direct investment in the US. Of the total of $19.7 billion spent on R&D, 69% came from European firms, dominated by Switzerland, and the same four major EU investors, namely Germany, United Kingdom, France and the Netherlands. More than half of the R&D funded by these affiliates was in chemicals (mostly pharmaceuticals) and computers (mostly communications equipment). Altogether, the research performed by the US affiliates of foreign firms accounted for 12% of all the research and development performed in the United States (Zeile, 1999).

In the evidence presented by Cantwell and Santangelo (2000), we note that between 1991 and 1995, the share of U.S. patents attributed to the research efforts by American firms abroad was only 8.62%, while as a share of the overall R&D effort the research performed abroad varied between 10-12% (National Science Board, 2002 4-60). Also the reverse seems to be true of European firms, where a high proportion of U.S. patenting, 16.47% to 55.69%, depending on the industrial sector, is due to the research performed outside of Europe (mostly in the United States). During the same period, the R&D spending accounted for by US affiliates of foreign firms rose from 10% to 14% (National Science Board, 2002 4-60) The differences in the two sets of measurements are due to differences in how firms patent, and how they spend money and

integrate themselves into local networks of innovation. Again, this is not to say that the extent of U.S. patenting resulting from research abroad is not important, but it is to say that for questions that concern the growth in innovative ability of a particular region, they alone are not a sufficient proxy for describing the impact of multinational activity.

What is particularly interesting, is the extent to which American direct investment has been financed for quite some time to a large extent by retained earnings, which has not been true of European investment abroad. According to the balance of payments statistics available from the Bureau of Economic Analysis, between 1992 and 1999, 42% of US direct investment was in the form of reinvested earnings (35% for US investment in Europe). By contrast, during the same period, reinvested earnings accounted for only 4% of European direct investment abroad, and only 6% of European investment in the US.

Indeed, from 1992 onwards, European investment in the United States has been primarily equity investment, and it has been equity investment in mergers and acquisitions rather than greenfield investment. From 1992, when greenfield investment accounted for 31% of foreign direct investment in the US, this proportion has diminished steadily to a low of 1% in the year 2000. Of course, part of this dramatic decline is due to the increasing role of mega-mergers (each worth $5 billion or more) in the past few years, but even in 1997, when no cross-border mega-mergers took place, the ratio of US businesses established to US businesses acquired by foreign investors and their existing affiliates was only 13%.[8] In other words, it would appear that while Europeans have been buying their way into markets and specialized capabilities in the United States, Americans have been building more gradually on their existing investments in Europe.

While these aggregate statistics shouldn't be taken too far, in the first instance the acquisition of research capability within the United States by European firms does not increase the amount of research performed or research personnel employed, as it merely shifts ownership

from one firm to another. By contrast, sustained reinvestment of earnings in the research intensive sectors would seem to indicate the presence of a different dynamic, possibly of the kind we have been discussing in this paper. Multinationals that had been initially attracted by an existing base of innovative research and highly skilled labor are gradually becoming more integrated into the local network, and are growing 'organically' within the cluster. Of course it is possible that this is happening within the European investment in the United States as well, but the aggregate picture doesn't give much indication that this is the case. (At a later stage, we aim to complement the figures presented here with evidence on alliance formation, which would present a richer picture of the linkages between innovative firms in the U.S. and Europe.) It should be pointed out, however, that there is no direct link between reinvested earnings and investment in research and development. The contention here is simply, that reinvested earnings for American firms have been of sufficient magnitude to finance their R & D activities abroad. For example, within the European chemical sector (mostly pharmaceuticals), American investment in R & D from 1994 to 1998 was 13.5 $ billion, while the cumulative reinvested earnings over the same period within the same sector amounted to 13.2 $ billion.

Conclusions

In this paper we have discussed the role of the multinational enterprise in connection with industrial innovation, and in particular MNE participation in high-technology clusters in Europe and the United States. We have argued that multinational firms are in a privileged position due to their ability to tap into localized resources in different markets. The benefits fro clustering arise from structural upgrading in a particular locations or region, which gives rise to pecuniary externalities in the form of access to a specialized workforce and specialist suppliers. Some of the benefits enjoyed by firms in such a cluster may also be due to pure knowledge spillovers, although these are difficult to track empirically. We have argued, that the ability of multinationals

to establish themselves in attractive clusters, and to secure their presence by substantial financial resources, makes them critical to the process of industrial innovation. We believe that the ability of large multinational firms to maintain steady levels of R & D investment is contributing to higher rates of innovation than would otherwise be possible. On the other hand, the ability of the multinational to do so is dependent on its ability to do derive profits from other activities. Consequently, one might suspect that the origins of financing for investment in innovation lie in profits based on the exploitation of market power.

The fact that nearly half of American foreign investment in the past decade has consisted of reinvested earnings points to two things. One, that in order to have reinvested earnings it is necessary to have earnings in the first place, and two, that high levels on reinvested earnings indicate a desire on behalf of American multinationals to gradually build on their existing investments abroad. This is in stark contrast to the behavior of European multinationals during the same period, whose investment consists almost entirely of equity investments in mergers and acquisitions. The structural implications of the American type of investment have been discussed at some length in this paper. This is a process of the gradual upgrading of innovative capacity based on the exploitation of highly skilled human resources attached to a particular location. The European type investment on the other hand, has very few short-term implications for structural upgrading. Some research and development capacity has changed hands from the Americans to the Europeans, and depending on how these resources are managed, this may improve the long-run competitive position of European firms.

We know that American firms are already well integrated among each other through strategic alliances in the key high technology sectors. The critical question for European multinationals is to what extent can European firms become insiders in the markets that they have entered. Assuming that knowledge doesn't in fact typically spill over, but that its transfer is

mediated by a web of relationships that places firms on the inside and outside, many large takeovers will neither enhance the acquiring firm's capabilities, nor enrich the existing relationships in the market. On the other hand, American multinationals attached to European clusters of knowledge and capabilities may in fact have become better integrated into the local networks, possibly due to their longer presence in the key markets.[9] From a public policy perspective, every effort should be made to ensure that foreign multinationals are able to continue this process, and to take part in local as well as EU-wide research networks. Allowing success to breed more success in any given location will naturally also result in greater disparities between regions. It would appear, however, that a policy to compensate poorer regions for being left behind may in the end be less costly that trying to orchestrate high growth regions where they haven't arisen under existing conditions.

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[1] Schmookler (1996), cited in Freeman and Soete (1997).
[2] 'Sticky places in slippery space' as Markusen (1996) put it.
[3] While Marshallian economies are generally seen as intra-industry, and urbanization economies as inter-industry, understandably in empirical work such definitions can be difficult to sustain.
[4] See also Teece (1991) on Japanese acquisitions in Silicon Valley in the 1980s.
[5] A firm that can finance its growth organically is of course also less dependent on the external market, and therefore also more protected from turmoil in world financial markets.
[6] See e.g. a special issue of *The Economic Journal* (Cressy, 2002).
[7] Both the financial and operating data pertaining to US direct investment abroad and to foreign investment in the US, as well as the balance of payments data have been downloaded from the Bureau of Economic Analysis, US Department of Commerce (www.bea.gov).
[8] The figures for affiliate investment reflect investment both by their foreign parents in terms of retained earnings and intercompany debt, as well as local financing arranged by the affiliate. Data from Howenstine (2001).
[9] Mudambi (1998) offers evidence that firms with a longer investment duration are more likely to make further investments.

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