to be able to export themselves. This implies that with regard to their own export activity tacit trade barriers still exist for East German firms.

We also find large effects for the – instrumented – degree of preparation for the euro. The better firms are prepared for the euro, the more likely it is that they expect to be able to enter new markets. The same is true for the expectation of developing new products. This shows that with increasing information and adaptation to the new European Market, firms realize individual opportunities to export and to develop new products. No significant effect of the degree of preparation is present for the expectation of being faced with new foreign competitors. For this category the variables for the degree of preparation are not even jointly significant.[33]

Altogether we find considerable effects on firms' expectations of the changes taking place in markets with the start of EMU. Both firms' strategic decisions and firms' expectations of being faced with new foreign competitors have been affected.

[33] A Wald test for joint significance was conducted here.

Bettina Burger*

How Important is Foreign Direct Investment for Late Industrialising Countries?

While it has long been recognised that the process of development is necessarily linked to technology, the question of the efficiency of technological spillovers from foreign direct investment remains controversial. The following paper examines the theoretical background and then focuses on the case of Mexico, analysing the technological performance of multinational enterprises in that country.

According to both historic trade patterns and theoretical insights, industrialised countries are specialised in the production of capital intensive and research and development (R&D) intensive goods while industrial latecomers export labour intensive goods and raw materials. Today, reality looks different: Asian countries especially not only challenge the industrialised world with their cost advantage but even compete through quality and innovation. One reason for this development is said to be imitation. With access to modern technologies in industrialised countries as well as access to service and information networks, industrial latecomers could catch up technologically with fewer resources than those needed for the original production and application of knowledge capital.

The real challenge for developing countries is to build up their domestic technological capabilities. In this sense, multinational enterprises (MNEs) are presumed to have a positive effect on the local economy because it is in their own interest to provide their foreign affiliates with advanced technology, to adapt it to local conditions and to make it operational. As some of the knowledge diffuses into the local economy, MNEs can powerfully affect the development of markets and economic agents in host countries. The efficiency of these technological spillovers through foreign direct investment (FDI) is still discussed controversely. The intention of this paper is to give reference to significant contributions in this field and to bring out some issues that are still underrepresented in the literature.

The paper is divided into four parts:

- an introduction into the concept of technological latecomer industrialisation and a briefing on what theory does and does not explain in this context;
- a sketching of those technological capabilities needed for local development and an explanation as to why FDI-based technological spillovers seem appropriate;
- a structural approach to the incentives of technology transfer and learning activities; and
- the results of an analysis of the technological performance of multinational enterprises (MNEs) in

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Mexico on the basis of proxies for firm-specific technological capabilities. The efficiency of technological spillovers is looked at for two industries where the role of foreign firms is particularly important (automobiles and electronics).

Latecomer Industrialisation: the Concept

It has long been recognised that the process of development is necessarily linked to technology and that technology must not only be viewed in its embodied form as product or process technology but also in its unembodied form of know-how or organisational practice. Because technological progress plays a large role in determining competitiveness, industrial latecomers are eager to accelerate learning processes to catch up technologically.

Industrial latecomers like South Korea, Taiwan or Mexico typically entered the twentieth century in an economically backward state based on raw materials. By selectively investing in industry these countries were then able to stimulate growth and raise their national income per capita significantly. The way they chose was not to develop technologies indigenously because a 'go-it-alone' strategy involves high risks of misallocating scarce resources and leading to relatively obsolete technology. The focus was on optimising technology transfer, exploiting the borrowed technology and penetrating world markets on the basis of low wages rather than a technological edge. In this sense the latecomer industrialisation differs from the early industrialisation that took place in the United States, Great Britain or Germany.

The technological gap between developed countries and industrial latecomers has given its name to a whole branch of literature within the theory of international trade, the so-called technology gap theory, which was originally based on the argumentation of Posner, Vernon and Hirsch.[1] Promising formal approaches are continuous models where technological know-how is unevenly distributed between two countries named 'North' and 'South'. While the North is innovative and in the technological lead position, the South tries to catch up via technology transfer from the North to the South. The North specialises in the production of goods where its productivity advantage is greater than its wage cost disadvantage. The South concentrates on the production of goods where its wage cost advantage outpaces its productivity disavantage. The production of so-called marginal products which can be produced at the same costs in both countries shifts from the North to the South or vice versa depending on the relative technological progress made in one of the countries. Model variations range from product to process innovation and from costless and exogenous technology transfer to one which has to be paid for and – integrating growth theory – can be influenced endogenously.[2]

The models show that under certain conditions the latecomer can gain from the technological progress that is transferred to the South. The microeconomic calculus on technology transfer, however, remains a 'black box' phenomenon as the models focus on country level characteristics rather than on industry or firm level characteristics. And with firms staying inside their national boundaries there is not much room for multinational activities. Thus, decisive questions are only given an unsatisfactory answer: why do firms go multinational by producing abroad? and what makes them support technological development in their host countries, if at all?

The Microeconomic Background

Foreign technology enters late industrialising countries through various channels such as licensing or imports. The crux is to make the foreign technology and the local development of technological capabilities compatible in order to reduce external dependence. This has raised the importance of technology transfer through FDI. FDI is defined as an investment in a host country where the investor acquires substantial power to control a company's entrepreneurial activities. In the extreme case the company is a totally owned subsidiary. Thus, in contrast to portfolio investment FDI means a long-term relationship. But what is even more important for host countries, MNEs are the most important actors in the generation, application and international transfer of modern technology.

According to patent statistics, the 700 biggest industrial companies – most of them MNEs – account for about half of all commercial innovations.[3] R&D is mostly performed at the companies' headquarters in industrialised countries like Japan, the USA, Germany or other European countries and is concentrated in

[1] M. V. Posner: International trade and technical change, Oxford Economic Papers, 1961, No. 13, pp. 323-341; R. Vernon: International investment and international trade in the product cycle, in: Quarterly Journal of Economics, 1966, No. 80, pp. 253-266; S. Hirsch: Location of industry and International Competitiveness, Oxford 1967.

[2] See e.g. G. Dosi, K. Pavitt and L. Soete: The economics of technical change and international trade, London, New York 1990, pp. 200 ff.; G. M. Grossman and E. Helpman: Innovation and growth in a global economy, London 1991.

[3] J. Cantwell: Transnational corporations and innovatory activities, in: UNCTAD (ed.): Transnational corporations and world development, London, Bonn 1996, pp. 145-180.

high and medium tech industries such as automobiles, electronics, machinery or pharmaceuticals. At the headquarters advanced knowledge in research, application and production is efficiently bundled. Nevertheless, growth rates in R&D done outside these leading houses indicate that subsidiaries are increasingly integrated into a cross-country network of knowledge production and learning.[4] A subsidiary established abroad is then not only equipped with embodied technology. It also receives unembodied technology by means of training measures which may include the exchange of technical staff between subsidiary and headquarters. In the wake of this technology transfer the MNE's technological knowledge diffuses via spillovers within the local economy, where it can stimulate industrialisation. If the MNE is not fully compensated for its investment into knowledge capital, we face the well-known problem of positive external economies where the private utility is lower than the social one.

In sum, foreign firms may provide a valuable first injection of new technology for host countries while allowing local companies to gain technological benefits through spillovers. There are various transmission channels for these technological spillovers. Basically, they can be of an intra-industrial or an inter-industrial nature.[5] Intra-industrial spillovers are restricted to the industry in which the subsidiary operates. Famous among them are the demonstration effect (learning-by-watching) and training externalities, when the industrial training provided by the MNEs becomes available to local companies due to a high turnover of trained workers and managers. In general, the transferability of know-how is higher, the less firm-specific it is. Inter-industrial spillovers are usually described as backward and forward linkages when in the vertical value-added chain knowledge is transferred to subcontractors or clients e.g. through technical assistance.

MNEs as Spillover Senders

What knowledge is of interest to the local companies and why are MNEs qualified in this respect as spillover senders? Along the line of Lall's argumentation, the following firm-level technological skills are required to build up industrial competitiveness in developing countries.[6]

☐ Investment capabilities determine how efficiently the resources available are allocated in order to produce or import knowledge capital that is decisive for the firm's market, product and process strategy.

☐ Production capabilities are necessary for an efficient use of knowledge capital comprising cost effective plant operation as well as improvements over time through quality control or process innovations.

☐ Linkage capabilities refer to skills in the transfer of unembodied and embodied technology between firms, and between firms and supporting institutions like research institutes. Especially in industries that are technologically close to each other, increases in productivity are often due to knowledge diffusion.[7]

As far as MNEs are concerned, it is common to describe them by means of their ownership and internalisation advantages. The theoretical roots of these terms are to be found in the 1960s, when Hymer proved that the traditional theory of foreign trade was inappropriate for modelling the existence of FDI.[8] In a more realistic approach it was assumed that a company investing abroad does not face the same conditions as the local firms. Instead the company is at a relative disadvantage when it comes to cultural and idiomatic surroundings, communication costs and so on.[9] Therefore the foreign investor enters the local market only when he has exclusive advantages, so-called ownership advantages. If the ownership advantage is a lead in the production and use of technological knowledge – as it is often the case with MNEs – the MNE qualifies for building up local investment and production capabilities through adequate spillovers.

Internalisation advantages are the key reasons why a foreign investor makes better use of his ownership advantages when he prefers the hierarchy (intra-firm) solution to the market mechanism. A main reason is information asymmetry between the seller and potential buyer of technological knowledge, which is due either to technical and economic uncertainties or

[4] ISI (Fraunhofer-Institut für Systemtechnik und Innovationsforschung) / IMI (Forschungsstelle Internationales Management und Innovation): Globales Management von Forschung und Innovation, Bonn 1996, mimeo.

[5] E. K. Chen: Transnational corporations and technology transfer to developing countries, in: UNCTAD (ed.), op. cit., pp. 181-215, here pp. 186 ff.

[6] S. Lall: Building industrial competitiveness in developing countries, Paris 1990.

[7] A. Goto and K. Suzuki: R&D capital, rate of return on R&D investment and spillover of R&D in Japanese manufacturing industries, in: The Review of Economics and Statistics, 1989, Vol. 71, pp. 555-564.

[8] S. H. Hymer: The international operations of national firms: A study on direct investment, dissertation, MIT 1960, pp. 48 ff.

[9] J. H. Dunning: Trade, location of economic activity and MNE: A search for an eclectic approach, in: B. Ohlin (ed.): The international allocation of economic activity, London, Basingsstoke 1977, pp. 395-418; J. R. Markusen and J. R. Melvin: The theory of international trade, New York, Cambridge 1988, pp. 303 ff.

to a lack of confidence.[10] As a consequence of high transaction costs, internalisation via FDI is the best way to capture the company's rents which leads to a continuous flow of know-how between the headquarters and its foreign affiliates.[11] And it is this networking ability which corresponds to the linkage capabilities sought by the local companies. Also important to note is that – according to empirical studies – this know-how transferred inside the hierarchy is in many cases more attractive than the technology offered in the market.[12] This means that the rate of local diffusion of innovations through MNEs could be much faster than through arm's length transactions.

Yet, it seems to be contradictory when a company whose multinational nature results from internalisation advantages does not seek to avoid any form of technological spillovers. The answer is that technology leakage in favour of local firms does not mean immediate imitation. Spillover efficiency requires the ability to learn. If someone is to be successful at learning, he must be able to absorb, adapt and transform the knowledge to put it on the market. Thus, research and development have a 'double function' being at the same time essential for innovative as well as imitative activities.[13] Local companies that do not invest in learning cannot expect spillovers to have a significant effect on their level of efficiency. Training externalities, for example, do not work when the absorptive capacity in the local firm is insufficient. Local companies, however, that do invest even have learning economies over time (learning to learn). And the more technological progress is of competitive relevance, the more companies try to exploit external knowledge. This complementary relationship or "crowding-in-effect" of FDI is often the case in modern sectors like electronics where the knowledge capital is concentrated and to which latecomer countries seek access.[14]

If local companies invest in learning activities, the MNE has to consider two effects.[15] On the one hand, intra-fim technology transfer makes the subsidiary's products more attractive in the local market, which usually leads to an increase in sales. On the other hand, the same intra-firm technology transfer makes those local companies more competitive that make use of spillovers in a cost-effective way. The technological gap between the subsidiary and the local companies shrinks and – along with it – the short-term profits of the subsidiary, provided that profits react elastically to changes in the technology gap. The original transfer decision of the MNE becomes suboptimal and transfer is increased. This can lead to a dynamic industrialisation process where local companies themselves act as spillover senders because they are more experienced in adapting external knowledge to local conditions.[16] If the common spillover pool is also advantageous for the MNE, the latter receives at least some compensation for its R&D-investment from the local companies. Figure 1 shows an ideal case in which further technology transfer can be stimulated.

The crucial point is that there is no such thing as costless technology transfer: foreign investors can choose the type of technology to be imported and the rate at which the transfers take place and they make their choice on the basis of an optimisation calculus. Apart from the costs which are directly related to the characteristics of the technology, the transferrer and the transferee there are costs which refer to the externality problem mentioned above.[17] Local learning activities, too, are a commitment of substantial real resources and therefore also depend on their profitability. These considerations show that a host country's expectations of gaining from FDI-based spillovers may remain unfulfilled because technology transfer is too expensive for MNEs. From this it can be concluded that a large presence of FDI may be accompanied by a slow technology transfer as well as by the transfer of relatively old technology. Whether or not there will be the technology transfer hoped for results from a complex interplay of determinants such as firm-specific features, market structure factors, government policies and worldwide competition tendencies.

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[10] M. Kamien and N. Schwartz: Market structure and innovation, Cambridge 1982, p. 2 ; G. Akerlof: The market for "lemons": Quality uncertainty and the market mechanism, in: Quarterly Journal of Economics, 1970, Vol. 84, pp. 488-504.

[11] R. H. Coase: The nature of the firm, in: Economica, 1937, pp. 386-405; O. E. Williamson: The economic institution of capitalism, New York, London 1985.

[12] E. Mansfield and A. Romeo: Technology transfer to overseas subsidiaries by U.S.-based firms, in: Quarterly Journal of Economics, 1980, Vol. 95, pp. 737-750; J.-Y. Wang and M. Blomström: Foreign investment and technology transfer – a simple model, in: European Economic Review, 1992, Vol. 36, pp. 137-155.

[13] W. M. Cohen and D. A. Levinthal: Innovation and learning: the two faces of R&D, in: The Economic Journal, September 1989, Vol. 99, pp. 569-596.

[14] IMF: How does FDI affect economic growth?, Washington 1994.

[15] J.-Y. Wang and M. Blomström, op. cit., pp. 141 ff.

[16] B. Burger: Ausländische Direktinvestitionen, technologische Spillover-Effekte und industrielle Entwicklung, dargestellt am Beispiel Mexiko, Baden-Baden 1998, pp. 65 ff.

[17] D. J. Teece: The multinational corporation and the resource cost of international technology transfer, Cambridge, Massachusetts 1977, p. 46.

The Environmental Incentives

Although firm-specific technological capabilities are the result of individual efforts and investment, they are not developed in isolation. In fact, they are crucially sensitive to external influences and interlinkages which arise from factor and product markets, infrastructure and institutions, or which are of a political nature. As Dosi, Pavitt and Soete point out: "... industrial organizations are of course the essential actors in technological accumulation, innovation and imitation ... but (industrial structures and technological gaps/leads) evolve along patterns which cannot generally be expected to show a simple linear relationship to each other."[18] This understanding has led to various attempts to classify incentives for economic development in a rather descriptive and broader way. Yet, although providing fruitful insights, the specificity of FDI-based technological spillovers in latecomer countries is usually neglected.[19] These spillovers are at the centre of an approach that comprises three incentive groups – product market and factor market incentives as well as institutional incentives:[20]

☐ *Product market incentives.* The development of firm-specific technological capabilities depends heavily on production structures, including industry structure and firm size. Incentives that encourage innovation, however, often do not stimulate knowledge diffusion which is necessary for local learning. Scherer describes the dilemma as follows: "What is needed is the proper blend of competition and monopoly."[21] Thus, an industrial latecomer has to be aware of the conflict between competition and industrial policy.

MNEs prefer to act in oligopolistic markets with barriers to entry created by economies of scale and technological requirements. This is consistent with the theory of MNEs described earlier. Thus, while the technological and managerial competence of an MNE can be of use to a country's development, there is also the fear that the MNE may impose excessive costs resulting from oligopolistic or even monopolistic behaviour. Latecomers often support the tendency towards concentrated market structures e.g. by granting direct investors access to highly protected infant industries. Apart from a market-inherent danger of concentration there is the possibility of policy-induced concentration by shielding 'insiders' from foreign competition. With a small number of market

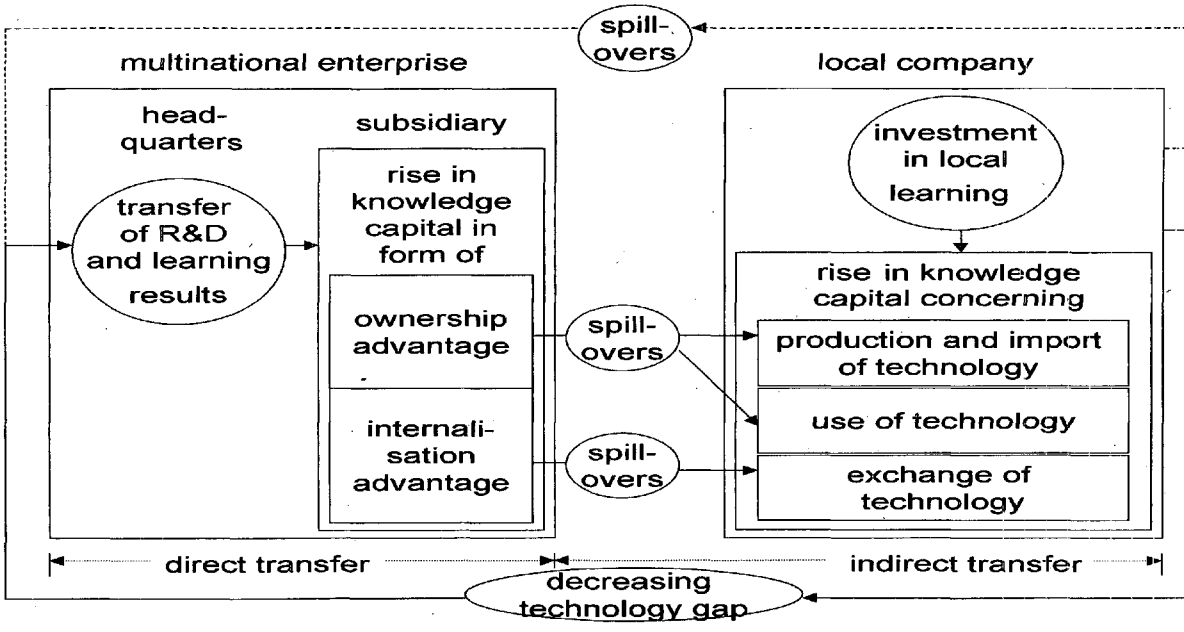
[18] G. Dosi, K. Pavitt and L. Soete, op. cit., p. 158.

[19] For example, OECD: Structural adjustment and economic performance, Paris 1987, pp. 18ff.; D. Ernstand, D. O'Connor: Technology and global competition: The challenge for newly industrialising economies, Paris 1989, pp. 48 f.

[20] B. Burger, op. cit., pp. 67 ff.

[21] F. M. Scherer: Innovation and growth: Schumpeterian perspective, Cambridge 1984, p. 127.

Figure 1



participants or weak price competition, there is not much room for FDI-based technological spillovers.

☐ *Factor market incentives.* Factor market incentives are mainly determined through the supply of financial capital, human capital and infrastructural goods. As far as these factors are supplied through market allocation, factor market incentives work in an analogous way to product market incentives. Yet, in latecomer countries signals on factor markets are often distorted due to an early stage of development. An insufficient supply of capital and qualifications then puts local companies at a competitive disadvantage while foreign subsidiaries can resort to intra-firm resources such as funds or training capacities for skill formation. A precondition for building up local technological capabilities is therefore to safeguard workable factor markets. Factor markets that do not work also make technology transfer excessively expensive, lowering the chance to have foreign subsidiaries as valuable spillover senders.

☐ *Institutional incentives.* Institutions, i.e. norms and organisations, determine the ability of individuals to respond to goods and factor market incentives.[22] Norms like property rights and guarantee instruments primarily serve as incentives for innovative activities. Organisations favour the efficient diffusion of knowledge capital either directly through authorities that ensure workable competition or indirectly through associations that provide information and enable networking at lower transaction costs.

Especially the protection of intellectual property favours the transfer of strategically important technology. An industrial latecomer therefore faces a dilemma situation. On the one hand, it is interested in importing this technology. On the other hand, a strict legal protection of property rights makes the leakage of knowledge capital in favour of local companies less probable. Some latecomer countries try to solve the problem by means of market entry and local content regulations. Yet both instruments tend to distort allocative efficiency in both the static and dynamic perspective.[23] As an alternative to regulation modern theory offers the solution of having the value of technology transfer negotiated between the MNE and the host country on the basis of firm-specific and locational advantages.[24] If the costs of negotiation are lower than the gain in external utility, allocation will be more efficient.

In the following the discussion turns to a case study to fill it with life. The focus is on Mexico, as FDI has been of great importance for the country's economic development for decades.

MNEs in Mexico

Since the 19th century MNEs have played a crucial role in Mexico's development. After an interruption due to the 1910 Revolution, FDI which had formerly been concentrated in railroads, mining and petroleum shifted towards Mexico's manufacturing sector. Since the Second World War especially industries such as transport equipment, electrical machinery and chemicals show an increasingly strong presence of foreign firms. FDI inflows were partly due to the industrialisation strategy of import substitution (IS) and therefore due to the fact that trade barriers shielded the domestic market from foreign competition and had to be overcome by establishing production capacities in Mexico. However, progressive nationalisation in some sectors like financial services, as well as the restrictive law on FDI of 1973 which made foreign majority ownership become an exception to the rule, put pressure on FDI activities.

In the wake of the debt crisis of the 1980s policy guidelines changed, giving room to economic restructuring and a closer interplay with international market factors and corporate strategies than during the highly protectionist periods. In 1994 the value of the FDI stock had quadrupled compared to the early 1980s and was worth some US$ 50.4 billion. In a total of 8,420 foreign subsidiaries (1993) 1.1 million people were employed which stood for 15% of total employment. In the manufacturing sector the number of foreign subsidiaries was 4,512 giving jobs to 773,000 people, i.e. 24% of the employment in this sector.[25] According to an analysis of sales figures for 1994, more than one third of the 500 companies leading in sales figures are multinational.[26] Figure 2

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[22] In contrast to the author's opinion, some representatives of modern institutional economics do not treat organisations as institutions; see e.g. D. North: Institutional change and economic performance, Cambridge 1990, pp. 4 ff.

[23] For a general discussion see M. Fritsch, T. Wein and H.-J. Ewers: Marktversagen und Wirtschaftspolitik, Munich 1993, pp. 70 ff.

[24] In a general context D. J. Lecraw and A. Morrison: Transnational corporations – host country relations: A framework for analysis, Essays in International Business, South Carolina 1991; R. Grosse: The bargaining relationship between global companies and national governments, Miami 1991.

[25] SECOFI (Secretaría de Comercio y Fomento Industrial),1996, information material given to the author; UNCTAD: World investment report 1996 – Investment, trade and international policy arrangements, New York 1996, p. 8; A. Calderón, M. Mortimore and W. Peres: Mexico's incorporation into the new industrial order: Foreign investment as a source of international competitiveness, in: United Nations: Desarrollo Productivo, No. 21, Santiago de Chile 1995, p. 37.

[26] Expansion: Las 500 empresas más importantes de México, Mexico City, August 1995.

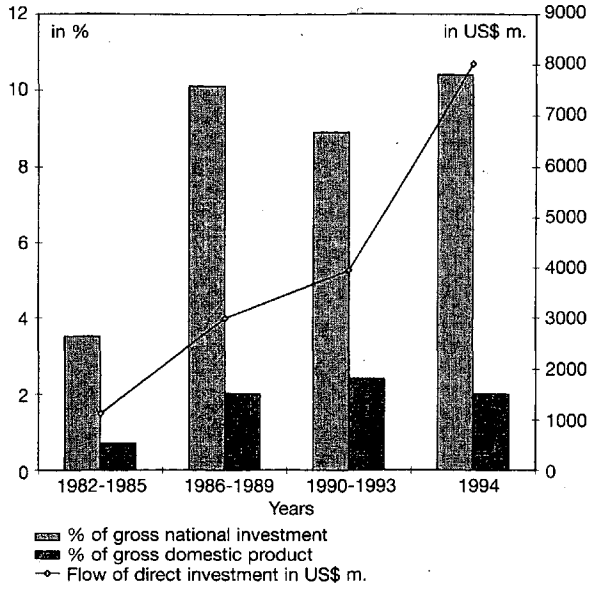
shows the importance of FDI-flows as a percentage of gross domestic product and gross investment.

Not surprisingly, MNEs have a strong presence in sectors that primarily produce modern capital goods or consumer durables like cars or electronical equipment, R&D intensive consumer goods like pharmaceuticals, or capital intensive intermediate products like industrial chemicals.

Let us now turn from FDI description to some observations on FDI-based technological spillovers in the country's manufacturing sector. One precondition for a favourable spillover relationship is that an MNE as a potential spillover sender brings its knowledge lead to Mexico. Another precondition is that the local companies as potential spillover receivers invest in technological learning or in their absorptive capacity. The incentives for doing so are in both cases basically determined by goods market and factor market incentives as well as institutional incentives. Therefore the following questions are of concern: how is the technological performance of MNEs in Mexico? do they have superior technological capabilities compared to their host country competitors? and given the answer is yes, is there evidence that an FDI-based technology transfer in favour of local companies takes place?

☐ *The production of knowledge capital.* One indicator for existing technological capabilities is the investment in technological knowledge. On the input side R&D expenditures, on the output side the generation of patents are commonly referred to. Empirical analysis for the manufacturing sector shows that MNEs have an ownership advantage in R&D activities. In Mexico about two thirds of R&D expenditures as a percentage of total sales are concentrated in those modern sectors (automobiles, chemicals etc.) which are dominated by MNEs. The level of patenting activities was also much lower at local companies. To cite an example: in the year 1992 some 7,695 patent applications were registered, of which 93% came from non-Mexican entities. In the same year in Korea the share of foreign applicants was 68% out of a total of 10,502 applications and in Taiwan 42% out of a total of 21,264 applications.[27] In an absolute sense, however, there is little R&D done in Mexico by MNEs or anyone else. Only 0.03% of GDP was spent by the private sector on R&D.

Figure 2



Note: Anticyclical behaviour of MNEs at the time of the stability crisis with high inflation and capital flight (mid-80s) was mainly due to the debt-equity swap programme. See CEPAL: Directorio sobre inversión extranjera en América Latina y el Caribe 1993: Marco legal y información estadistica, Mexico City 1993, mimeo, p. 346 ff.

The weak R&D performance is mainly due to factor market incentives, as qualified R&D personnel is scarce and mainly bound in the state sector. As the state's R&D activities are mainly isolated, the private economy does not profit from the results. Even if the R&D output in the state sector were of use to the private companies, there would barely be any institutions to lower the extremely high transaction costs. Additionally, property rights became stronger only at the end of the 1980s with a positive effect on private R&D. In sum, the innovative-imitative environment in Mexico until the mid-90s was too weak to stimulate a significant growth of knowledge capital in local companies. In this sense, the precondition for an active spillover process remains unfulfilled. On the demand side, macroeconomic instability and high losses of purchasing power also weakened the incentives for technological learning.

☐ *The import of knowledge capital.* An alternative to the production of knowledge capital is to have it imported. Indeed, in Mexico substantial resources went into obtaining technology from abroad at what might well be lower opportunity costs. As discussed above, MNEs with their leading houses seem to be suitable intermediaries in this process. If firm-specific know-how is mobile, which is especially the case with unembodied technology, then know-how is not only the knowledge concentrated in one location but the whole stock of intrafirm know-how worldwide.

[27] OECD: Science, technology and industry outlook, Paris 1996.

[28] B. Burger, op. cit., pp. 138ff. One reason for the importance of intra-firm technology transfer is also restrictions on foreign exchange transactions. As in the case of Mexico, these restrictions made a repatriation of profits through payments for licences and royalties attractive for MNEs.

In Mexico the affilitates of MNEs also conducted relatively less R&D than their parent companies at home. Yet they received most of their technology by means of intrafirm transfer.[28] Local firms invested less in licensing and royalties than MNEs and received most of their technology through arm's length transactions. Yet, analysing the data of the National Register for Technology Transfer blurs the picture. Politically enforced market segmentation and burau-cratic regulations supported the transfer of trade-marks or other marketing instruments rather than the transfer of technical or organisational knowledge. Due to insufficient property rights and limit prices owners of modern technology hesitated to sell modern technology to Mexico at all, as indicated by the results of an UNCTC survey among 63 companies with foreign capital participation.[29] Thus, according to the interviews MNEs welcomed deregulation at the end of the 1980s when the law on technology transfer was modified.

☐ *The use of knowledge capital.* Not every R&D expenditure leads to an innovation, not every patent will be used in production. Useful indicators of potential FDI-based spillovers are therefore levels and rates of changes in labour productivity. A glance at sectoral data between 1980 and 1993 reveals a higher productivity (yearly average) for sectors with MNE dominance.[30]

In a series of papers the impacts of MNEs on local productivity have been analysed in more detail.[31] On the basis of census data, Blomström and Persson test the correlation between labour productivity in local companies (measured as value added per employee) and the MNEs' presence for 215 industries and the year 1970 using the least squares method. The results indicate that there is a positive effect of foreign presence on the productivity level of national firms in the same industries even after accounting for standard industrial organisation variables such as the quality of human capital, capital labour ratios and the scale of production in individual plants. However, it is not clear which potential gains for Mexico are implied due e.g. to untapped returns to scale during the periods of strict import substitution. If the import of technology was restricted as described above it seems probable that foreign firms increased the productivity of national firms through competitive pressure rather than by speeding up the transfer of technologically advanced knowledge. In addition to that the studies neglect that technological learning is dynamic in nature. Proving spillover effects means at least the comparison between two sets of yearly data.

Unluckily, data accounting for a firm's nationality is hardly available. This is also a problem when using external trade as an indicator for market results of technological learning. According to Unger, Mexican-owned firms dominate in the export of technologically stagnant and homogenous products while MNEs prevail in the trade with R&D intensive or differentiated products.[32] There has been no foreign ownership of oil, and very little in other major raw material products such as cement or steel or in agricultural products. The role of R&D and technical progress in the products traded and the production methods involved can, at best, be inferred indirectly from economic figures. In order to identify spillover results behind the dynamics and complexity of the total economy, case studies are often of greater use. In the following reference is made to the electronics and automobile industries where MNEs are dominant. In the past decades, these industries have experienced a shift away from pure knocked-down kits to increasing technological complexity of assembly operations.

☐ *The exchange of knowledge capital in the Mexican automobile and electronic industry.* The exact pattern of inter-firm linkages depends upon the technical characteristics of the products and the relative sizes of the firms concerned. But as the discussion of incentives for local learning has shown, the extent of linkages created depends on the availabilitiy of local skills and technology as well as on institutions and government policies. A highly inward-looking regime like that of import subsitution induces all firms, regardless of ownership, to buy large proportions of their inputs from local sources. In Mexico MNEs have consequently established extensive relationships with local companies. This was mainly due to local-content regulations, a ban on vertical integration for foreign automobile producers and a restricted market entry in the autoparts industry.

However, many of these linkages did not produce spillover benefits and the resulting production facilities proved to be internationally uncompetitive. General difficulties associated with local procurement

[29] T. Huss: Foreign direct investment and industrial restructuring in Mexico, UNCTC Current Studies, No. 18, New York 1992.

[30] B. Burger, op. cit., pp. 145 f.; for older data see F. Fajnzylber, and T. Martínez: Las empresas transnacionales, Mexico City 1987.

[31] M. Blomström: Foreign investment and spillovers, London, New York 1989; M. Blomström and H. Persson: Foreign investment and spillover efficiency in an underdeveloped economy: Evidence from the Mexican manufacturing industry, in: World Development, 1983, Vol. 11, No. 6, pp. 493-501.

[32] K. Unger: Competencia monopólica y tecnología en la industria mexicana, Mexico City 1985.

were technological backwardness, a small scale, poor quality, high costs and unreliability in timely delivery. As Ruiz shows in a survey among 18 Japanese affiliates in Mexico and 61 subcontracting companies in industries like automobiles, motorcycles and electrics/electronics, even Japanese MNEs which are famous for system partnerships did not apply their philosophy in Mexico.[33] Their local suppliers therefore remained unsatisfied with the direct technology transfer that they received. Nevertheless, more than half of them stated that they either already have implemented parts of the Japanese organisational system or plan to do so. This refers especially to the establishment of decentralised quality control, group responsibility or training measures. Thus, the impulse from cooperation seems to be stronger than officially stated.

The Japanese affiliates themselves complained of insufficiently qualified human capital. A high fluctuation of low qualified personnel made training extremely expensive, reducing the potential of training externalities. In addition to that, infrastructural weaknesses in telecommunication and transport caused high safety stocks and therefore high stock-bound costs.

MNEs' knowledge transfer remained restricted to a dozen local industrial conglomerates.[34] This is quite obvious given the dual structure of the local industries where only some big companies have the means to invest in their absorptive capacity while the mass of small and medium-sized local companies works on a technological level so low that detailed product design or international standard specifications provided by a foreign subsidiary can barely be matched. Thus, foreign enterprises left the 'traditional' part of an industry mostly unchanged and immediately excluded it from backward linkages when trade liberalisation started in the mid-80s with Mexico joining GATT. Together with a deregulative policy, trade liberalisation allowed MNEs to substitute local suppliers through imports or through enforced local production of foreign suppliers. With globalisation and trade liberalisation, it became evident that the investment of the Mexican government in human capital, infrastructure and institutions had been too low to ensure a sufficient generation of local knowledge and skills as the system evolved during the past decades. Thus, there was not enough room for FDI-based spillovers to be significantly beneficial to the host economy.

Conclusions

In sum, there is evidence of a positive impact of foreign firms on technological progress in Mexico although this impact seems to be quite limited in scope. A country like Mexico that lacks a coherent national science policy should not expect significant benefits through FDI-based technological spillovers. Given the country's rudimentary technology infrastructure, some MNEs are simply unable to transfer advanced techniques. And spending much more on purchasing technology from abroad than on domestic capabilities, local companies are simply unable to profit from potential spillovers. With trade liberalisation and deregulation sweeping the developing world there will be fewer differences in the policy factors that attract investment flows and more transparency in locational disadvantages. As seen for Mexico, such disadvantages are especially an insufficient quantity and quality of qualifications and infrastructural goods. Political priority should therefore be to provide workable factor markets that do not form bottlenecks during the catch-up process. In order to acquire access to superior MNE training capacities, latecomer countries can offer political incentives like tax reduction in a process of negotiations if this allows a better internalisation of external utility.

Governments are also required to ensure a systematic and market-facilitating competition policy. The fundamental industrial organisation approach would argue that the nationality of a company is of lesser importance than specific characteristics of the industrial subsector. Why should local firms be less active in transferring skills, know-how and product design than MNEs once they have technologically caught up? And it seems right that an important key to the generation and diffusion of knowledge capital is the type of oligopolistic conditions in a market.

There are interlinkages between market structure and a company's/industry's competitiveness, technology and investment flows, domestic capability development and government policies. These interlinkages have grown closer due to the internationalisation of production and the growing significance of trade. Technology generation is more and more based on global considerations, despite the concentration of innovations in a handful of countries and companies. Industrial latecomers have to take this into account when they go for FDI-based technological spillovers.

[33] C. Ruiz: The role of Japanese direct investment in developing countries: The case of Mexico, in: Institute of Developing Economies (ed.): The role of Japanese direct investment in developing countries, Tokyo 1995, pp. 164-267.

[34] B. Burger, op. cit., pp. 153 ff.