Integration, technological transfer and intellectual property rights: an empirical application to the MENA countries.

Maria Giovanna Bosco*

Bocconi University, Milan
June 2001

Abstract

One of the positive outcomes stemming from economic integration is the technological transfer that takes place through trade and foreign investment. Foreign investment is likely to be affected by many factors, but one particularly is likely to enter a MNE decision, especially when an investment in high –technology sector is concerned: the level of intellectual property right protection in the host country. A high protection (as in the standards of the TRIPS Agreements in the WTO framework) offers the MNE the opportunity to exploit profitably its intangible assets and to invest in future research and development. On the other hand, local governments, mostly in developing or transition countries, have an incentive not to hinder knowledge diffusion by means of restrictive intellectual property laws so to favor local businesses and protect them from foreign competition. Using a firm level database of FDI initiatives in the Middle East and North Africa countries, this framework is applied to the case of the MED partners in the Barcelona process, in order to assess 1) if foreign investment decisions' were affected by the level of intellectual property right protection in the host countries, 2) if, given these conditions, technological transfer by means of FDI is likely to be effective. From the political economy point of view, we will investigate if the Euro-Med initiative is promoting efficiently knowledge and technology diffusion in the Mediterranean area.

Keywords: economic integration, foreign investment, intellectual property rights
JEL classification: F23, O34.

* The author is Research and Teaching Assistant at IEP, Università Bocconi, Via Sarfatti 25, 20136 Milan, ITALY. This paper is part of the author PH. D. thesis.
Phone: +39.02.5836.5423. Fax: +39.02.5836.5439. Email: mariagiovanna.bosco@uni-bocconi.it

1. Introduction.

A challenging research frontier in the literature on foreign direct investment in developing or transition countries is the technological transfer and the different factors that may enhance or hinder the process. When a multinational company settles abroad, carries together a set of tangible and intangible assets that translates in the increasing stock of knowledge for the host partner. Consequently, the dynamic gains from economic integration include increased competition for local firms, decreasing costs for new technologies and, as a result, a strong impact on economic growth.

When a firm decides to de – localise a branch of its activities, one of the criteria driving the process is the ownership advantage, that is the possibility to run autonomously e profitably the own strategic bulk of knowledge. If retaining internally some activities, as Research and Development, is crucial in order to gain or defend the market power, protecting products, process, brands and ideas in general is the empirical instrument that allows reaching this goal[1]. So, since the Renaissance, there exist patents and copyrights; today, the variety of Intellectual Property Rights Protection instruments has increased, depending also on the specific sector of application (Braga, Fink, Sepulveda, 1998; Maskus, 1998).

High technology in economic activity often needs high protection, since the ultimate results stemming from Research activity can be copied and then the remuneration of the innovation effort is lost. The working hypothesis we make is that developing or transition countries have a strong incentive to attract high – tech FDI, since the gain in terms of growth is likely to be significant. The creation of technological districts, agglomeration and backward and forward linkages (Markusen and Venables, 1999) are seen as a vehicle of knowledge diffusion, a positive externality for the whole community. Even if trade is still the main channel of technological transfer (Djankov and Hoekman, 2001), we can't forget that a large share of world trade is between MNE as internal trade between holdings and branches. So FDI and trade are complementary instruments of knowledge diffusion.

The technological transfer associated to the MNE's life can be internal or external. It's internal, when it's a part of the firm in itself (a branch) to move abroad; it's external, when a firm turns to licensing procedures, joint ventures, or outsourcing: a third partner is involved. In this last case the risk of leaking out precious internal information is higher: usually, only low value processes are externalised as accounting or commercial functions, while technologies are transferred under specific agreements.

The working hypothesis must be completed with an observation: often governments of host countries face a trade - off between granting a proper legal protection to intellectual property rights and allowing a "popular" knowledge diffusion without imposing high standards of protection, so to facilitate

[1] The fractions of the value chain usually externalised are the commercial and marketing function, the final refining in sectors as garments, appliances manufacturing, etc..

imitation[2]. So, while investors operate according to the maximisation of profit, disregarding humanitarian motivations in their goals, political authorities insert into their "utility function" various interests.

In the reality, we need to investigate if the formal legal protection is implemented successfully, accordingly to international standards and conventions; often, the perception of foreign investors about the quality legal protection is scarce. Accessing to new technologies is costly so that minimisation of these costs is one of the aims of the local governments.

The effectiveness of IPRP (Intellectual Property Right Protection) is hard to evaluate, because long bureaucratic procedures, widespread corruption in administrative matters, make the de - localisation or externalisation of the own technology less easy and straightforward. The empirical and theoretical literature supports our hypothesis on the technological transfer side (Coe and Helpman, 1995; Lichtenberg 1996) on technology spillovers modelling (Blomström and Sjöholm 1999; Konings, 1999, Aitkin and Harrison, 1999) and, specifically, on the relationship between FDI and intellectual property rights protection (Mansfield, 1994, and 1995, Smarczynska, 1999). The paper is organised as follows: the next paragraph carries over a technology intensity analysis of foreign investments in the Mediterranean area, assessing the relationship with the ownership issue; in the third paragraph, some evidence is provided on the status of legal protection of intellectual property rights and on investors' perception, on the basis of some surveys. In the fourth paragraph a simple economic model, with some strategic considerations, sheds some light on the firm's incentive to transfer high level technology in a foreign country. Estimation of an econometric model for this case is provided. The fifth paragraph concludes.

1. Technological intensity and ownership structure: some microeconomic evidence.

The core activity of high tech firms is often concentrated in their Research and Development function, since the advantage they gain on the market can be defended against potential competitors only through a continuos innovation. It is quite understandable how important this function is for the firm's life, and how strategic it is to maintain a complete control on it. Rather that considering licensing procedures to third partners, one can think that perhaps many of these firms settling abroad will like to participate directly in the initiative, in the hope not too leak out commercial secrets[3].

Starting from this point, it makes sense to investigate if actually FDI in the MENA region reflect this characteristic. We should remember two points, when trying to explain the high tech FDI pattern in the

[2] It's out of our aim to discuss the ethics of certain cases, as the recent judgement against pharmaceuticals in South Africa.

[3] Commercial secrets, together with patents, trademarks, industrial design and copyright are protected by law, both under national legal systems and under international agreements such as the TRIPS agreements after the Uruguay Round (1995).

MENA[4] countries: first, the total FDI inflow in the area has been inferior to expectations (Petri, 1997); second, the widespread perception among investors of weak intellectual property rights protection, together with high macroeconomic and social risk, can be a reason why high tech industries are not particularly attracted by this context. One of the hypothesis made in precedent works (Mansfield, 1995) is that for MNE of high tech type, it is more likely to observe investment agreements with a 100% participation, by means of full acquisitions, *greenfield* investments or directly, branches creation. Here, we'll test the hypothesis that there exists a positive correlation between technological intensity and percentage of foreign participation in the FDI initiative.

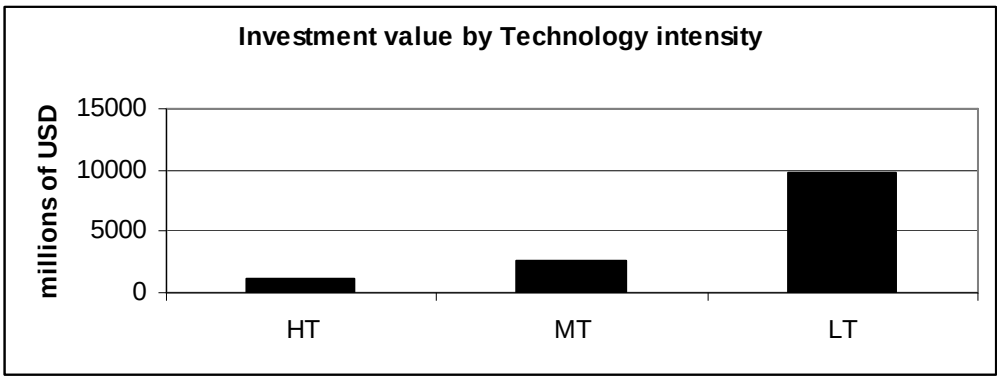
The data bank we refer to contains observations at firm level, with detailed information on the kind of activity and financial participation. From this data we could run a preliminary analysis on technology, on the basis of a triple classification: high tech (HT), low tech (LT) and medium tech (MT). This classification is applied according the OCDE criteria (Hatzichronoglou, 1997); actually the classification is far from being pacific; another similar classification is presented in Blomström, Lipsey and Ohlsson (1991), but different activities are subjected to technological progress and some may become more technology intensive in time. Moreover, some processes contain both high tech and low tech phases.(Chabot, 1996). On the basis of the data, the number of FDI in low tech is higher that other categories: they represent 52% in the sample, in front of 18% for medium tech and 31% for high tech. This confirms what already found in other studies (Petri, 1997) and international reports (UN, 1999): *resource oriented* and *market oriented* FDI prevail, mostly in mining, food and textile, even if in these later years there's a certain reverting trend for pharmaceuticals. In the low tech sector, food and textile represent respectively 34% and 22%. In the high tech sector, chemical firms are dominant with 71%, while electronic represent 26%. A view of the sample distribution of initiatives is given in Table 1.

Table 1.

	Technological Intensity			
Countries	HT	LT	MT	Total
Algeria	17	4	5	26
Cyprus	1	6	1	8
Egypt	30	39	17	86
Israel	41	25	7	73
Jordan	10	9	1	20
Lebanon	8	4	1	13
Malta	5	8	4	17
Morocco	28	57	20	105
PNA	1			1
Syria	3	3		6
Tunisia	25	94	16	135
Turkey	45	111	50	206
Total	214	360	122	696

[4] We use MENA or MED countries to indicate the same group of twelve partners.

Turkey is the leader as a host for high tech foreign investments, followed by Israel, and this data is quite impressive if we consider that Turkey has a population of more than 65 millions people while Israel only has about 6 millions inhabitants (IMF, 2000). This results in about 6,8 initiatives per capita in Israel and 0.7 in Turkey: so absolute values must be considered only very carefully. When looking at value data for all kind of FDI, we can see that Israel has been the leader receptor, with 2256 millions US$ in 1999 (WIR, 2000), while Turkey (783 m$) only comes after Egypt (1500 m$), Morocco (847 m$), and Malta (811 m$). So the pattern is quite clear: the specialisation of MED countries is focussed on medium value – low technology initiatives, if we don't consider the oil sector; Israel is an *outlier* in this context. By the hand, Turkey follows a pattern quite different from the other MED countries, and in a certain sense preferential, since it is involved in a Customs Union with EU since 1996. Analysing a sub sample of our data for which firm level investment value is available we can see that the total value of investments in the LT is pretty larger than in MT and HT. This confirms what already said on the number of FDI initiatives:



Source: Elaboration on own data set.

Another view is obtained by plotting the number of initiatives by category against the percentage of foreign participation: it confirms what assumed earlier: that is, there's a positive, certain relationship between high participation and technology intensity:

Table 2.a

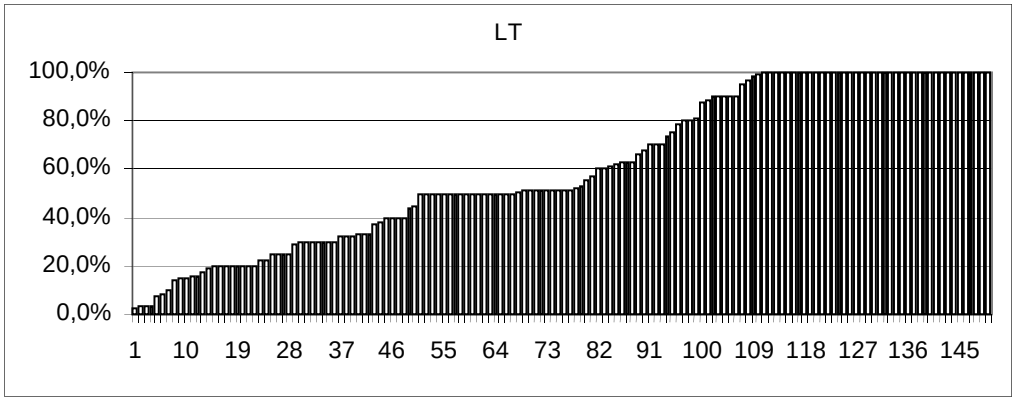


Table 2.b

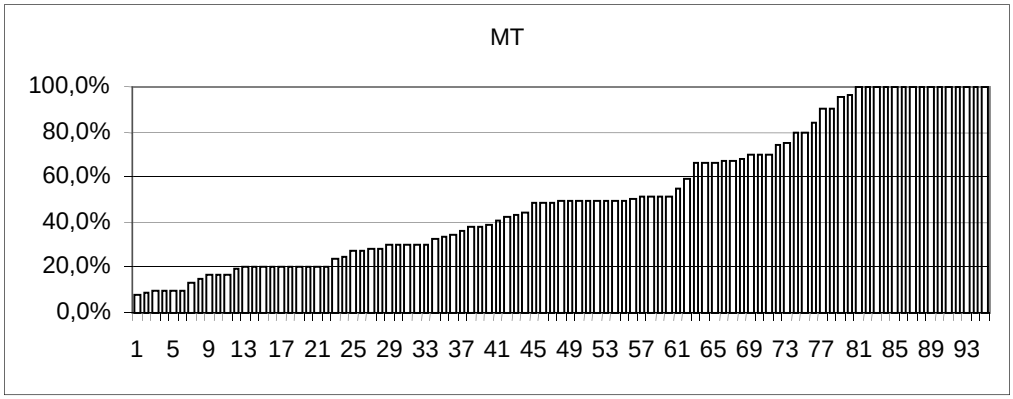
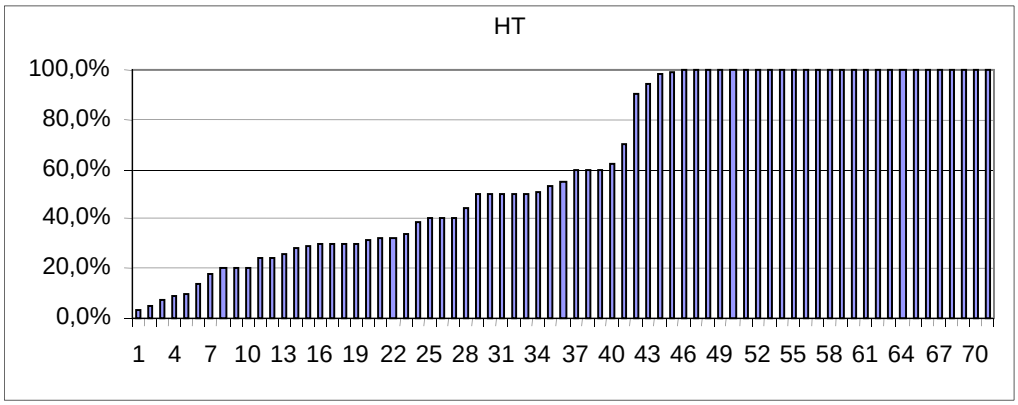


Table 2.c



Source: Elaboration on own data set.

The percentage of investments with a share of 100% in the foreign initiative is sharply larger in the high tech category with respect to medium an low tech. In the LT the 100% threshold is reached in the 24% of cases, in the MT in the 16% and in the HT in the 37%. This emerges in table 2.C, where the distribution of high tech firms with respect to the share of participation is markedly more right – skewed than those in table 2.a and 2.b and supports our hypothesis. Knowledge –intensive investments, or R&D intensive investments, show the tendency not to share on the operative side their assets with local partners. The aim of this strategy is to protect firms' own commercial secrets and defend some comparative advantage and profitability. The framework for shares between 80 and 99% is instead quite controversial. Indeed, while in the HT sector this category only covers 5,6%, it reaches 7,4% in the MT and 11,3% in the LT. This strong variation in the data could have some intuitive explanation. If a company engaged in heavy R&D expenditure is to choose a HT investment, prefers to acquire a

complete control of the new business, not to leave small freedom margins to potential competitors and leak out strategic information. So the choice of HT firms is more extreme than MT or LT firms, for which the risk of sharing vital knowledge is less stringent. The distribution in tables 2.B and 2.C is consequently flatter.

From this preliminary analysis we can conclude that, as a rule, high tech industries' firm prefer to keep a majority control over local partners/ affiliates: this could mean that strategic assets are knowledge driven. Technological transfer is likely to happen only under certain secure context conditions and proper legal protection, as required by firms, together with their own presence on the foreign market. We could then infer that there's a correlation between number of HT firms, technological transfer and legal protection of intellectual property rights: there exists a self reinforcing mechanism, leading firm to take into consideration the legal environment and the effectiveness of protection; as a result, technological transfer is likely to be stronger in the presence of a high number of FDI. To an extreme extent, FDI can be seen as a proxy for technological transfer in broad sense. Other factors influence the decision to settle abroad, among which we need to stress the importance of a legal and macroeconomic safe context.

2. FDI and intellectual property rights protection.

Even though some empirical studies (Mansfield 1994 and 1995, Smarczynska, 1999) investigate the relationship between the choice of a FDI and the degree of intellectual property rights protection (from now on, IPRP), for MED countries information is not easily accessible, and based on two main sources: firm level private surveys and international organisations' field studies on the subject. Actually, external viewers may obtain a more objective view of the problem than local authorities do. Main critics come from organisations as the Intellectual Property Rights alliance, which is an U.S.A. based organisation. These considerations must anyway be taken into account when making an economic evaluation of the issue.

The first firm level survey comes from Bocconi University (Foreign Direct Investment in the Mediterranean Countries), and it was originally conceived as a Report for the European Commission. It covers a sample of European firms, and contains a questionnaire over different investors' perception of factor influencing their decisions. Also IPRP enters significantly. Table 3 summarises the findings.

Table 3. Factors negatively affecting FDI decisions in MED countries.

	Egypt	Israel	Turkey	Jordan	Morocco	Cyprus	Algeria	Lebanon	Palestine	Syria	Tunisia
Infrastructure	**4**	**4**	**6**	**4**	**4**	**7**	**5**	**3**	**4**	**7**	**1**
Discrimination against foreigners	**1**	**1**	**1**	**3,5**	**1**	**-**	**1**	**2**	**1**	**2**	**1**
Financial markets efficiency	**3**	**2**	**8**	**4,5**	**4,5**	**6**	**9**	**3**	**4**	**9**	**-**
IPRP laws	**4**	**3**	**1**	**5**	**8**	**1**	**1**	**2**	**3**	**3**	**1**
Bureaucracy	**10**	**10**	**5**	**8,5**	**8**	**-**	**10**	**7**	**6**	**9**	**6**

Note Higher values correspond to higher level of criticism. Ranking is 0 = low, 10= high.

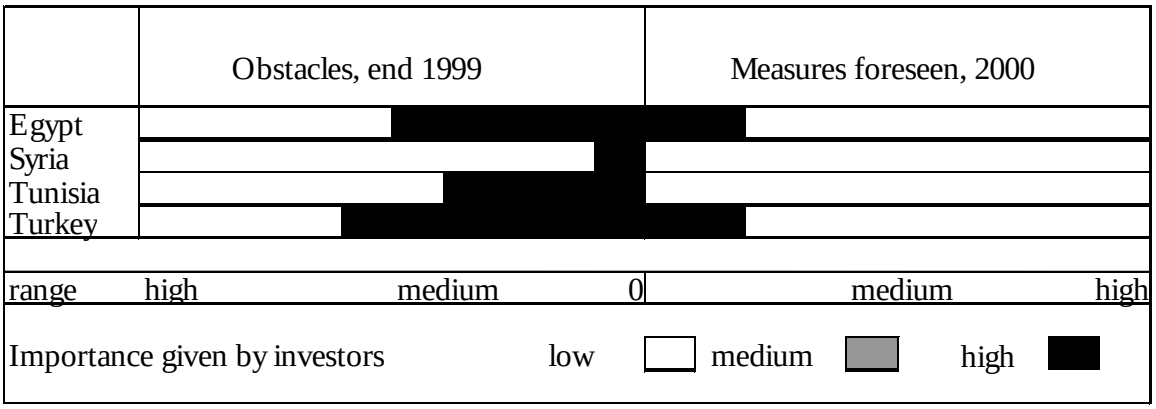
Source: Bocconi, 2000.

This results should be handed carefully as there may be a strong correlation between the first major obstacle to FDI, bureaucracy, and the goodness of laws on IPRP. IPRP laws weakness is particularly evident for Morocco, Egypt and Jordan. It is reasonable to think that much of the discomfort felt by foreign investors is due to the non-clear application of rules, rather than simple lack; that's why it is difficult to weigh the importance of this factor.

Bureaucracy is the worst factor, but also financial market inefficiency. Unfortunately, we can't tell the firm "technology type", so that here average answers coming from all type of firms are included. Discretion is the bad feature that discourage new business activities.

The second survey is called "Improved Investment condition" and concerns investment opportunities in developing countries, and it has been elaborated by the United Nations and the International Chamber of Commerce. Only some MED countries are included in the list, but the report on each is quite careful. The definition of obstacle to IPRP is precise and also refers to remuneration, in that some countries keep on hindering the principle of payment of patents, trade marks or licensed technologies. Statistics here refer to investment conditions and are summarised in Table 4.

Table 4. Obstacles and perspectives for FDI in IPRP and remuneration.



Source: ERT Report, 2000.

Table 4 only refers to a sub sample of MED countries, but still Egypt and Turkey are quite problematic in terms of legislation over IPRP. Actually, measures were taken in 2000 so to conform to TRIPS agreements, but still in the practice laws are hard to enforce.

International organisations represent another source of information, even if reports over TRIPS implementation only give a broad idea of the economic situation of countries. A very critical position is the one of the IIPA (International Intellectual Property Agency), that annually prepares some control lists of countries considered unsafe as for the status of IPRP application; without forgetting that the comparison is carried with reference to USA legislation and article 301 on foreign commercial policy. These lists range from the most problematic countries (PFC, Priority Foreign Countries) to those more effective in fighting piracy and giving adequate IPRP, (PWL and WL, Priority Watch List and Watch List). Only some MED partners (8 out of 12) were inserted into these list, mainly because of the lack of official information. Israel, because of increasing piracy, has been inserted in the PFC list; Palestinian Authority and Turkey were inserted in PWL, Egypt and Lebanon in the WL. Cyprus and Jordan belonged for a long time to WL. Tunisia is not studied because of the lack of information.

Table 5: Recommendations from IIPA to USTR.

	IIPA recommends	OCR Result	Ranking USTR									
Country	**2000**	**1999**	**1999**	**1998**	**1997**	**1996**	**1995**	**1994**	**1993**	**1992**	**1991**	**1990**
Palestinian Authority	**PWL**		-	-	-	-	-	-	-	-	-	-
Cyprus			-	-	**OO**	**OO**	**OO**	**WL**	**WL**	**WL**	**WL**	**WL**
Egypt	**WL**		**PWL**	**PWL**	**PWL**	**WL**	**WL**	**WL**	**PWL**	**PWL**	**WL**	**WL**
Israel	**PFC**	**In prog.**	**PWL**	**PWL**	**WL**	**OO**	**OO**	**OO**	-	-	-	-
Jordan			**OFF**	**WL**	**WL**	**WL**	**OO**	**OO**	-	-	-	-
Lebanon	**WL**		**WL**	**OO**	-	-	-	-	-	-	-	-
Tunisia				**OO**								
Turkey	**PWL**		**PWL**	PWL	PWL	PWL	PWL	PWL	PWL	**PWL**	**WL**	**WL**

Note:
PFC: **Priority foreign country**
PWL: **priority watch list**
WL: **watch list**
OO: **other observations**
PP: **priority practices**
OR: **open recommendations**
OCR: **L'IIPA recommends a special revision by USTR.**

From: IIPA 2000 Special 301 Recommendations.

The main conclusion we can draw from this evidence is that MENA countries still have to implement their legal system regarding intellectual property rights; even though some reforms were undertaken, this wasn't enough to convince foreign investors about the certainty of the local context. So the process

should be twofold: besides the process of accomplishing to international standards, also the image and credibility of local governments in this field should be reinforced.

3. Economic modelling and strategic considerations.

4.1 Strategic interactions…

The basic idea in past studies over FDI and IPRP was to determine if an adequate patent and law protection was significant in determining the pattern of FDI inflow in a country (Maskus, 1998; Mansfield, 1994 and 1995; Smarczynka 1999). We will use this framework in our empirical application over MED countries FDI and IPRP laws, but here we want to focus on some political economy considerations that may help understand the economic model underlying the interaction between a multinational enterprise (MNE) and a local government of the potential host country (GOV). Actually, past works stressed the decision making process of the firm, following an international business approach and implicitly supporting the Dunning's O.L.I. paradigm. Here instead, what we'd like to outline is the interaction between the MNE on one side and the GOV on the other, since the two actors have different incentives.

If we define a game theoretic approach to this interaction, we find that the MNE has an incentive to transfer a technology of new type to the local partner if local conditions (social, economic, political and legal) promote the protection of its activities; on the other hand, the local government faces a trade – off: on one side, he needs MNE to transfer new technologies, but also wants this new knowledge to circulate freely as to let local firms benefit from it, even by illegal means. This type of behaviour of course, encounters the hostility of foreign investors; and moreover, of the international community of western countries where protection of intellectual property rights respects high standards. But local community maybe instead love and support a government struggling against MNE monopoly power and asking a fair treatment.

Suppose this scenario:

- There exists a MNE deciding to transfer or not a new technology in a foreign country with similar characteristics to those of a MED country; risky environment, political instability, low skilled labour, medium high market potential, natural resources and workforce. The risk is that, was the new technology copied under weak legal provisions, the profit to the MNE would be lower or zero;
- There exists a local authority, a government, caught in a "political cycle", with an incentive to set a weak legislation to conquer local political support; notwithstanding, this manoeuvre is negative economically, because technological spillovers could just be lost as only the legal owner can make a correct use of it.

The solution to this dilemma, is far from pacific, depending o the weight that the local authority puts on IPRP; if it doesn't meet effective high standards, probably MNE will only transfer low valued added activities to the host country, conserving high tech processes and R&D activities in the headquarters. So, to implement the optimal outcome of high technology transferring and high IPRP, it is necessary to induce a change in the government's preferences. In a dynamic game, the interaction has to be infinite.

Suppose a one-shot simultaneous game of complete information. There are two players, MNE and GOV. The structure of the pay – offs is crucial: it must reflect the dynamics of gains, losses and incentives, and the outcome changes with values. A co-operation equilibrium is almost impossible in a uncertainty context. Let:

$$a, b, c, d, \text{ with } a > b > c > d$$

be the payoffs values. Let's assume that the maximum outcome – granting maximum welfare to community - to GOV and MNE is the one where the MNE transfers a high - type technology and the GOV lifts an adequate IPRP and FDI protection regime. Suppose the GOV has a strong incentive to deviate from the maximum welfare – co-operative equilibrium, as to let knowledge spread freely.

Even if the MNE would get the maximum earning from transferring and exploiting a high technology, in a risky context, she'd rather transferring an old or obsolete one, no to leak out industrial secrets and lose the competitive advantage. The matrix would be:

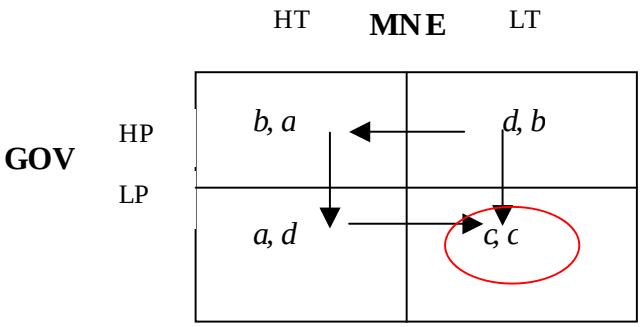
		Mne	
		HT	*LT*
Gov	*HP*	b, a	d, b
	LP	a, d	c, c

The MNE has two moves: HT or LT, that is high or low technology. The GOV has also two choices: grant high or low protection to intellectual property rights (HP or LP). With respect to the classical prisoner dilemma's case, the structure of payoffs s not symmetrical, as the outcome of (LP, LT) must necessarily be different from (HP, HT) to reflect different incentives.

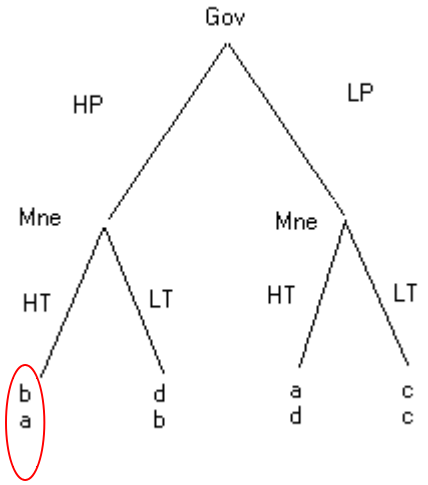
The distribution of payoffs follows from the hypothesis. When MNE plays HT and GOV plays HP, payoff is *b, a*: MNE obtains the maximum benefit, while GOV obtains a benefit quite high, but not as high as in the case he could avoid employing all the resources necessary to implement a safe legal environment. If GOV plays HP and MNE plays LT, payoff is *d, b*: the loss in terms of welfare and costs encountered are largest, and the profit for MNE is inferior with respect to the case when HT is

transferred. If GOV plays LP and MNE plays HT, the gain will maximum for the GOV, since will have a new technology almost freely accessible to everybody in the country, without heavy legal apparatus to protect patents or trade marks, for example. Finally, if GOV plays LP and MNE plays LT, payoff is medium for both.

There aren't high costs of protection for GOV, but also high profits for MNE or improved welfare are missing. Anyway, for MNE profit is lower, but always better than the case she had transferred HT, *ceteris paribus*, and lower than the case in which at least a proper legislation was in force. The equilibrium follows this path:



Given the payoff ordering, the result cannot be Pareto optimal, that is (HP, HT); the only possible Nash equilibrium is (LP, LT), giving c, c, which is dominated by b, a. Actually, the problem is that LT is a dominant strategy for the GOV; it would be necessary a scheme altering the government preferences. This can only be possible in a series of infinitely repeated games. Here, the Nash equilibrium is paradoxical; just as in the case of the Prisoner's Dilemma the outcome is inefficient. Suppose we can rule out uncertainty due to simultaneity of opponent's moves, transforming the game into a dynamic one. With the same payoffs, but letting the MNE observe the GOV choice in advance.



The only Nash equilibrium here is *b, a,* not reachable in the previous game. The economic interpretation of this result follows from assuming a sequence in the game with perfect information: this leads player to finish in a Pareto – optimal equilibrium. The absence of risk is beneficial to both of them, in that the new technology is transferred within an adequate legal framework and the two utility functions are maximised. Coming back to the previous simultaneous game with incomplete information, one can think of a scheme of incentives leading to the Pareto equilibrium in an infinite horizon. To force this result, a quite know method (Gibbons, 1992) is the *trigger strategy*, which consists in adopting a punishing non co-operative behaviour against the opponent whenever he doesn't co - operate in the previous stage of the game. Notwithstanding, with respect to the classic Prisoner's Dilemma case, the trigger strategy here is in a certain sense unilateral, because the incentive to deviate from the "good" equilibrium only belongs to the government, as the MNE would always prefer to transfer the HT for her own profit. What we need is the incentive for the GOV not to deviate from (HT, HP). The trigger strategy shows as an outcome, failing to be a Nash equilibrium in a one-shot game, can become a sub game – perfect equilibrium in an infinite horizon. If, given a past of co-operation by the MNE till the time t-1, the GOV decides to co-operate, playing HP if MNE plays HT, the present value of the payoff is:

$$V = b + \delta b + \delta^2 b + \delta^3 b + \ldots = b + b\sum_{t=1}^{\infty} \delta^t = b + b\frac{\delta}{1-\delta}$$

where V is present discounted value and δ is the discount factor. Evidently the incentive is a function of the weight given to future payoffs: the higher δ, the more GOV cares about future stability of technological transfer from abroad, the safer the co-operative equilibrium. If GOV decides to deviate from (HT, HP), he'll obtain *a* today, followed by an infinite series of *c* as the MNE adopted the trigger strategy:

$$V = a + \delta c + \delta^2 c + \delta^3 c + \ldots = a + c\sum_{t=1}^{\infty} \delta^t = a + c\frac{\delta}{1-\delta}$$

Comparing the two payoffs one can deduce the δ granting stability to the co-operative equilibrium:

$$b + b\frac{\delta}{1-\delta} \geq a + c\frac{\delta}{1-\delta}$$

$$(b-c)\frac{\delta}{1-\delta}+b-a\geq 0$$

$$\frac{(b-c)\delta+b(1-\delta)-a1-\delta}{1-\delta}\geq 0$$

This inequality is satisfied for δ: $\frac{a-b}{a-c}\leq\delta<1$, with $\frac{a-b}{a-c}>0$.

The implication for the game is that values of the discount factor belonging to the set above makes it optimal for the GOV to play HP; for certain values of δ, playing LT becomes a dominated strategy.

From the economic point of view, is it possible to make credible a cost sufficiently high so to deter the GOV from the non co-operative strategy? A clear example is given by the Club Theory: for the government would be optimal to belong a certain group of countries, that for example, required to adopt some particular social and economic policies. This is what was required with Maastricht parameters to the now members of the European Union. So, a government of a country "outsider" with respect to countries already forming a club could find it desirable to change its policy orientation in order to join the group. The Mediterranean free trade area of 2001 could have some of these characteristics? It is up to the EU to make the club desirable.

4.2 ..and firm's strategy.

Let's try to see the problem from the single MNE enterprise point of view: try to act as to face the risk of a low or lowered protection of intellectual property rights. We start from a model developed in Smarczynska (1999) based on Rodrik (1991) for a profit maximising decision. Suppose a firm already decided upon an investment in a third country[5], and has to decide upon the technological complexity of the process or products to locate in the host partner. So we're supposing the firm can decide the intensity or degree of technological transfer.

Suppose the firm faces a binary choice: HT or LT, depending on the expected profit from the investment. In our case, the uncertainty of the profit is due to the probability that an actual low IPRP wouldn't guarantee a proper remuneration for the own patents, trademarks or copyright, or, even worse, there was room for piracy or pure free imitation. Nonetheless, the effectiveness of IPRP can only be measured by the practice.

The firm will transfer the HT if:

[5] This hypothesis simplifies the analysis since all the factors affecting the decision of an investment rather simple exporting or not having commercial relations are ruled out. The target is already set.

$$E(\Pi_{HT}) > E(\Pi_{LT})$$

that is, in case the profit stemming from HT technology is larger than the profit under LT technology. Suppose there are some fixed costs of entry into market, a part of which due to the reorganisation of the internal structure, *firm specific*, α, and a part due to the local market, *market specific*, β. In a simple two –periods horizon, the randomness of the profit depends on the Probability that IPR are violated, leading to a loss *l* in the next period. The firm will transfer HT if the expected profit, given by revenue less costs, are larger than when transferring LT:

$$R_1 - \alpha_1 - \beta_1 + \pi\left(\frac{-l_1}{1+r}\right) + (1-\pi)\left(\frac{R_1}{1+r}\right) > R_2 - \alpha_2 - \beta_2 + \pi\left(\frac{-l_2}{1+r}\right) + (1-\pi)\left(\frac{R_2}{1+r}\right)$$

$$(R_1 - R_2) + (1-\pi)\left(\frac{R_1 - R_2}{1+r}\right) - (\alpha_1 + \alpha_2) - (\beta_1 + \beta_2) > \pi\left(\frac{l_1 - l_2}{1+r}\right)$$

where π is the probability to incur in a loss due to a weakening of legal IPRP of investment and intangible assets; (1-π) is the complementary probability that the investment remains profitable: l_1 is the likely loss, larger in case of HT because there would me more resources invested. The rationality conditions are:

$R_1 > R_2$	by assumption
$l_1 > l_2$	by assumption
$\alpha_1+\beta_1 > \alpha_2+\beta_2$	cost function monotonicity from HT to LT
$0 \le \pi \le 1$	definition of probability
$0 \le r \le 1$	discount factor

Simplifying and assuming r = 0, the condition becomes:

$$(R_1 - R_2) + (1-\pi)(R_1 - R_2) - (\alpha_1 + \alpha_2) - (\beta_1 + \beta_2) > \pi(l_1 - l_2)$$

The "excess return" resulting from the transfer of HT rather than LT, both present and expected , net of fixed costs, must be larger that the expected loss in case of default of IPRP standards. Given the parameters' structure, fundamental is the probability distribution between the two events, π: when the probability of a default increases, also the expected loss increases and expected profit decreases.

To sum up, we tried to transmit the strategic considerations on which actors' choices are based The item on which they bargain is an intangible asset, knowledge, that also has many characteristics of a public good, that's why it generates so many externalities. The firm always put profit first, so that IPRP become a variable that can indirectly affect her maximisation problem outcome.

4. Econometrics of IPR and data.

The literature on IPRP at empirical level is not redundant, due to the lack of data concerning transition and developing economies. Although some studies (Markusen, 2001) deal with the issues at conceptual level, finding the data to implement econometric application is far from being pacific and easy. Data are promptly available for western countries, mainly for US, which, moreover, are often the parameter to measure the degree of IPRP in other nations. Mansfield (1994) and Smarczynska (1999) are example of empirical application; in particular, the second work is an extensive case for FDI in the CEEc countries.

Consider the FDI initiatives in a country in a certain time period, and suppose that, as usually, different factors affect the firms' decision. The basic idea is quite common in the literature (Blomström, De Gregorio, Lee, 1998; Aitkin and Harrison, 1999): try to explain the presence of foreign firms in a country starting from the "local approach", that is, examining some typical characteristics as riskiness, market dimension, its growth, political stability (often present under the risk level), and institutional variables as the IPRP .

Precedent studies showed how market dimension is an important determinant of FDI (Blomström, De Gregorio, Lee, 1998; Maskus, 1998); GDP or population are the proxies commonly used for different samples. GDP growth if often referred to as expressing market potential rather that actual attractiveness. Macroeconomic risk is summarised in some indexes elaborated by international organisations of consultancy firms, for example the ORI and PRI by Business Environment Risk Intelligence (Switzerland) or by Dun & Bradsheet Associates. To compute an indicator for IPRP one can refer to the already mentioned Reports and Watch List of the IIPA, as a significant number of countries are included in these reports. It is possible that the fear of IPRP violation or non – implementation deter firms from investing in some countries abroad, and so, also in some of the MED countries. These IIPA lists do not cover the whole of the MED sample and the classification and criteria are not uniform through time. A previous empirical work (Ginarte, Park, 1997) instead built an index of IPRP for 110 countries, with the aim of finding a correlation in a multidimensional perspective between protection and FDI. This index covers five years from 1960 to 1990, applying a scheme over national laws on patents. Five categories are examined within the laws: (1) protection extension; (2) participation in international organisations or treaties about intellectual property rights; (3) measures in

case of loss of protection; (4) implementation and enforcement mechanisms; (5) length of protection. For each of these classes, a point between 0 and 5 was attributed. The simple average of these points is the index: for MED countries, results are reported in Table 6.

Table 6: Patent right index for some MED countries.

Sample period: 1960 – 1990.								
	1960	1965	1970	1975	1980	1985	1990	*Ranking (1990)*
Algeria	3.05	3.05	3.38	3.38	3.38	3.38	3.38	2
Cyprus	1.90	1.90	2.24	2.24	2.24	2.24	2.24	5
Egypt	1.99	1.99	1.99	1.99	1.99	1.99	1.99	6
Israel	3.04	3.57	3.57	3.57	3.57	3.57	3.57	1
Jordan	1.52	1.52	1.52	1.86	1.86	1.86	1.86	7
Malta	1.56	1.56	1.89	1.89	1.89	1.89	1.89	6
Morocco	2.38	2.38	2.38	2.38	2.38	2.38	2.38	4
Syria	2.46	2.46	2.46	2.46	2.46	2.46	2.46	3

Source: Ginarte and Park, 1997.

What emerges from this table is that through years legislation has been reinforced and extended, as index grows uniformly for al countries. This result support our next step, that is the construction of a similar index on the basis of the information provided by Abu – Ghazaleh Intellectual Property in the publication "Agip Handbook 2000", in which detailed information is contained about the protection system for patents, designs, etc.. in the Arab countries and for all the countries in the world in a comparative approach. For every country, sufficient information is contained as number of categories protected, length of the protection, bureaucratic procedures, costs of application. Using a similar criterion as in Ginarte and Park (1997) on a 0 –100 basis, a new index was built for IPRP efficiency in the MED countries, as summarised in Table 7.

Table 7: IPRP index for MED countries.

Country	**Intellectual Property right protection index**	**Ranking (2001)**
Algeria	41.25	6
Cyprus	40	7
Egypt	26.5	10
Jordan	21.5	11
Israel	60	1
Lebanon	35	8
Malta	46.25	5
Morocco	47.5	4
Palestine	47.5	4
Syria	30	9
Tunisia	52.5	3
Turkey	53.75	2

The interpretation is straightforward: higher values of the index correspond to higher standards of IPRP. This index largely reflects what already computed by Ginarte and Park as for ranking and weights; the difference is that we could include also Turkey and Tunisia, placed here at the second and third place, determining as a consequence a shift in al other positions. Israel remains close to western standards and ranks 1 within the group; Egypt occupies a very bad position, and this is even worst if one thinks that Egypt has become the leading country as receptor of FDI; before Egypt, only Jordan got a lower placement, while the other countries stand in the middle of the two extremes[6]. This data bank contains detailed information of firms' type of partnership by host country, starting year, geographic location, amount of capital invested, sector of economic activity by Nace Rev. 1 and Nace CLIO, the taxonomy by Pavitt (1984), and the technological intensity. Data as GDP, GDP growth, population and trade come from the World Bank Global Network Development database.

5. Estimation and results.

The structure of the data base allows us to use a binary choice model. In this case the dependent variable only assumes 0 and 1 as values and OLS estimation is not indicated anymore, since what we estimate now is the probability that the dependent variable is 0 or 1, and it's hard to limit the coefficients from OLS estimation to range only in [0,1]. Moreover, the variance of the error term, which distribution is not normal in this case, is heteroskedastic and depends on regressors and parameters. In our case, we model the dependent variable as the probability to observe an investment in country *i*. As we deal with a large sample, we use a cross section approach putting together the 12 MENA countries' FDI through 10 years. The most commonly used models are Probit, Logit and the Linear probability model. These model describe the probability that in the model:

$$y_i = x_i^{'}\beta + \varepsilon_i$$

the y_i variable is equal to 1: intuitively, it estimates the effect of explanatory variables over the percentage of "1" in the sample. It is possible that the model stems from some economic or behavioural hypothesis, and this would lead to a representation for latent variables in the model. That is, y_i would be conditioned by choices or preferences that don't show up in the model since not directly observable: the utility theoretical function deriving determines y*, unobservable. Here the explanatory variables are the demographic and economic dimension of country, riskiness of economic and political context , a IPRP index, trade with EU, weight of high tech in imports. The hypothesis here is: the

[6] As for the data for FDI in the MENA region, the source is a private data bank built by Professor Alessandrini and his staff at Bocconi University.

MNE – or just firm – decides to undertake the FDI if y* is superior to a certain critical threshold. Structure is so straightforward. Given a utility function defining y*, the endogenous variable equals 1 if a firm has an investment in the region in the sample period, is 0 otherwise:

$$Y_i^* = X_i\beta + u_i$$
$$Y_i = 1 \quad if \quad Y_i^* > 0$$
$$Y_i = 0 \quad otherwise$$

where X is the vector of country characteristics: the micro and macro dimension are melt together within this approach. Notice that the X vector also contains a constant catalysing those effects that at aggregate level affect the probability to observe a FDI, omitted in the model. On the basis of a Probit regression, we obtained the following:

Table 8: Probit estimation.

	1 FDI	2 FDI	3 FDI	4 FDI	5 FDI	6 FDI
Population	0.069		0.012*	0.019*	0.011*	0.019*
	(2.46)		(0.002)	(0.0015)	(0.002)	(0.001)
GDP	-0.038	0.0079*				
	(1.64)	(0.001)				
GDP growth	9.17	7.30*	7.58*	-2.43*	5.72**	
	(64.17)	(3.4)	(3.34)	(1.21)	(3.2)	
Riskiness	-0.012	0.02	0.014	0.035*	0.032*	0.022*
	(1.13)	(0.01)	(0.017)	(0.010)	(0.015)	(0.006)
IPRP	0.079	0.024**	0.033	0.0092**	0.014	0.013*
	(1.92)	(0.014)	(0.013)	(0.0056)	(0.009)	(0.003)
HT imports	0.0009	-0.0003*	-0.0001*		-0.00001	
	(0.043)	(0.00)	(0.000)		(0.000)	
Trade with	-0.007	-0.014**	-0.013*	-0.0083*		
European Union	(0.043)	(0.0063)	(0.006)	(0.003)		
	1981	1981	1981	2830	1981	3113
observations						
$\chi 2$	151.8	151.22	151.61	246.5	147.27	271.33
Prob > $\chi 2$	0.000	0.000	0.000	0.000	0.000	0.000
Pseudo R2	0.09	0.089	0.092	0.125	0.0876	0.1327
Log Likelihood	-764	-764	-764	-863	-766	-886

Note: standard errors in brackets.
* = significant at 5% level
** = significant at 10% level

We tried different specifications of the model and we can conclude that there some underlying supported structure in the data. First we should notice that usually the determination coefficient in these type of model is quite low (Verbeek, 2000) so that we should not be surprised with finding values

of the Pseudo R2 well below 0.2. This is due to both the dispersion in the data, the large number of observations, and the estimation technique in itself.

The local economy dimension seems to be best captured by either population or GDP, but not the two together. The correlation between these dimensions introduces a bias in the estimation (model 1) as the GDP is not significant and has the wrong sign, so that the simultaneous presence is dropped in models from 2 to 6. The GDP growth is positive in four cases and significant in three out of these four. The growth rate of the economy embeds the potential of future development, and according to this view, those investors aiming at this kind of markets are foresighted, that is, hope to earn higher profits in the future from increased consuming potential. It may be that some other investors are not foresighted and just look at current profit: in this case they would probably avoid investing significant shares of their capital in the foreign partner, externalising low value added activities, as final assembling in manufacturing. So, even if GDP growth is mainly positive, we find a contradictory result in model 4. The global risk index is positive in all but one case, and significant in 3 out of 5. As the index decreases if global risk increases, this means that the probability of observing a FDI initiative is positively affected by lower global risk. Two control variables for external factors affecting FDI were inserted: The share of high tech imports in total imports and the percentage of trade with European Union. The economic ratio for this choice is intuitive: since intra – industry trade is typical of patterns between similar countries, we may suppose that with a development of a Science based sector (Pavitt, 1984) in the local economies of MENA countries also the type of goods traded will reflect this change. So, there may be a correlation between FDI in high tech sectors and trade flows, even if it is hard at this stage of the analysis to detect the direction of causation. Of course a country – by – country analysis would put in evidence that this would mainly occur for Israel.

The discouraging result is the one for EU trade: we have always negative and significant signs, which is counterintuitive, since EU is the main commercial partner for Maghreb countries, and is also very important for Middle East countries, so we'd expect a positive correlation, for the complementarity issue well seen in the literature. Actually, the disappointing fact is to find a negative and significant sign, rather than a mixed –sign and insignificant. There may be an economic explanation for this, based on the cited literature: FDI from EU tend to substitute for commercial flow within the same groups of countries. The interesting result is the one of the IPRP index. The sign is always positive and significant in 3 cases. This supports our idea: better standards of legal protection of intellectual property rights increase the probability to observe a FDI.

This preliminary econometric estimation helps us to assess what already found in previous econometric works: rising standards of IPRP positively affect the probability of observing a FDI.

6. Conclusions.

This study is a preliminary step toward the FDI implications of IPRP in the MENA countries. One of the main challenges of the Euro Mediterranean partnership is to promote economic integration; in this framework FDI play a crucial role in that facilitate the movement of factors and people. Among various aspects of factors affecting FDI are the Intellectual Property Rights. High standards of protection offer a better environment to potential foreign investors and protect the future return of R&D investment. In the case of MENA countries we could compute an index of effectiveness of this protection and put it into relation with the probability of observing a FDI initiative. Which seems to be positive: that is, higher standards of protection spur FDI. Tying the first section on FDI and technological intensity and the second one on FDI and IPRP, we can conclude that if FDI in high tech sectors are those likely to cause the bulk of technological transfer abroad, high standards of IPRP promote the venue as adequate site for high tech industries, boosting this way the knowledge diffusion. It would be interesting to carry on a specific study country by country also introducing microeconomic determinants as wages and rental cost of capital. Other aspects as R&D expenditure and agglomeration effects, likely to occur with good infrastructure, could also be included. The policy implication from this evidence is straightforward: governments should strategically create an attractive framework for investors, knowing that transfer of knowledge is easier in the presence of high IPR standards and keeping into account the future returns from deterring illegal IPR violation.

Bibliography.

Abu-Ghazaleh Intellectual Property, "Intellectual Property Laws of the Arab Countries", Kluwer Law International. 2000.

Aitkin, B. J. and Harrison, A., "Do domestic firms benefit from direct foreign investment? Evidence from Venezuela", American Economic Review, 89 (3), pp. 605-618.1999.

Alessandrini, S. "Foreign Direct Investment in the Mediterranean countries – Third Interim Report". Università Commerciale Luigi Bocconi, Milano, 2000. Study financed by the European Commission.

Bayar, A. H., "Fiscal challenges on the Euro – Mediterranean agreements", 1999.

Blomström, M., Lipsey, R.E., Ohlsson, L., "What do rich countries trade with each other? R&D and th ecomposition of US and Swedish trade". NBER reprint N. 1551 (from Banca Nazionale del Lavoro Quarterly Review, N. 173, 215 – 235; june 1990), 1991.

Blomström, M., and Sjöholm, F. (1999). "Technology Transfer and Spillovers: Does Local Participation with Multinationals Matter?", European Economic Review, Vol. 43, pp. 915-923.

Borensztein, E., DeGregorio, J, and Lee, J-W. (1998). "How Does Foreign Direct Investment Affect Economic Growth?", Journal of International Economics, Vol. 45, pp.115-135.

Chabot, C., "Defining High Technology", Techné: Journal of Technology Studies Program in STS Building, 370, Stanford University, retrieved from www.stanford.edu/ group/ STS/ techne.shtml, mimeo, 1996.

CNEL, V Rapporto sul Mediterraneo "Economie Mediterranee" – sistemi produttivi locali tradizionali e di nuova formazione – Cooperazione Sud –Sud e Nord –Sud. 1999.

Coe, D., Helpman E., "North –South R&D Spillovers", CEPR Discussion Paper N. 1133, 1995.

Economic Research Forum, Economic Trends in the MENA Region, 2000.

El Hedi L.M., "Foreign direct investment, the European Mediterranean Agreements and trade liberalization between MENA countries", ERF, OECD, WB, 1999.

FDI in the Mediterranean Countries – Final Report for the European Commission, Università Commerciale Luigi Bocconi, 2000.

Galal, A., Hoekman, B., (ed.), "Regional partners in global markets;: limits and possibilities of the Euro – Med Agreements", CEPR, ECES, 197.

Gibbons, R. "A primer in game theory", Harvester Wheatsheaf, N.Y., 1992.

Ginarte,-Juan-C.; Park,-Walter-G., " Determinants of Patent Rights: A Cross-National Study", Research-Policy;26(3), October 1997, pages 283-301, 1997.

Hatzichronoglou, T., "Revision of the high-technology sector and product classification", OECD, 1997.

Konings, J., " The effect of foreign direct investment on domestic firms : evidence from firm level panel data in emerging economies" (Leuven: Katholieke Universiteit, LICOS), Centre for Transition Economies Discussion Paper No. 86, 1999.

Investment Policy Review Egypt. UNCTAD, 1999.

Lehman, A. Bruce, Support for economic and political freedom, USA Department of State, International Information Program, 2000.

Lichtenberg, F., Van Pottelsberghe de la Potterie B., "International R&D and Spillovers: a re-examination". NBER W.P. 5668, 1996.

Mansfield, E., "Intellectual Property protection, Foreign Direct Investment and Technology Transfer", IFC, W.B., Discussion Paper N. 19, 1994.

Mansfield, E., "Intellectual Property protection, Foreign Direct Investment and Technology Transfer – Germany, Japan and the United States", IFC, W.B., Discussion Paper N. 27, 1995.

Markusen, J. And Venables, A., "Foreign direct investments as a catalyst for industrial development", European Economic Review, n. 43, pp. 335 –356, 1999.

Maskus, K. E., " The role of Intellectual property Rights in encouraging foreign direct investment and technology transfer", Duke Journal of Comparative and International Law 109, 1998.

Michalet. C-A., "Investissements étrangers: les économies du sud de la Méditeranée sont –elles attractives?, Monder arabe Maghreb Machrek, Hors série, dicembre 1997.

Padoan Pier Carlo, Technology accumulation and diffusion. Is there a regional dimension? 1997.

Pavitt, K.L.R., "Sectoral patterns of Technical Change: towards a Taxonomy and a Theory", Research Policy 13, 343-373, 1984.

Petri, Peter A., The case of missing foreign investment in the Southern Mediterranean. OECD Development Centre Technical Papers, N. 128, 1997.

Primo Braga, C. A., Fink C., Sepulveda C. P., "Intellectual Property Rights and Economic Development", 1998.

Rodrik D., "Policy Uncertainty and Private Investment in Developing Countries", Journal of Development Economics, 36, November 1991.

Rolli Valeria, Gli investimenti diretti italiani nel Mediterraneo: caratteristiche e confronto con altri paesi europei. 2000, in "Le economie del Mediterraneo", Banca d' Italia, 2000.

Sacerdoti, G., Alessandrini S., "Regionalismo economico e sistema globale degli scambi", 1994.

Sapir, A., Nagarajan, N., "Euro – Mediterranean Free Trade: Meeting the Challenges" , IMF/ EC seminar, 1998.

Smarczynska, B. "Composition of foreign direct investment and protection of intellectual property rights in transition economies", CEPR Discussion Paper N. 2228, 1999.

Trade Policy Developments in the Middle East and North Africa, MDF, World Bank, ERF, 2000.

UN, ICC, - European Round Table of Indutrialists, "Improved Investment Conditions – Third Survey on improvements in conditions for investment in the developing world", 1999.

Verbeek, M. " A guide to modern econometrics", J. Wiley and Son, London, 2000.

World Investment Report 2000. UNCTAD.