SECTION II:

‘GROWTH ENGINES’ OF THE NODE ECONOMY

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4. INVESTING IN AN EMERGING NODE: FOREIGN-OWNED COMPANIES IN THE TEL AVIV ECONOMY

4.1 INTRODUCTION

This chapter investigates Israel's role as an 'emerging node' in the global economy through the prism of foreign direct investment (FDI). Empirically, we investigate the probability that a foreign-owned firm will locate in Tel Aviv. Foreign ownership is taken here as representing one facet of globalization. While we are aware that globalization processes encompass much more than the presence of foreign investors in the domestic economy and should also include some investigation of Israeli firms operating abroad, this topic will be touched on, inter-alia, through the analysis of patterns of FDI. As will be noted, much of this latter process is bound up with FDI in that many Israeli, technologically advanced, firms that try to break into global markets do so through by being incorporated or traded abroad (see chapter 6 and also Haaretz, 2000; Red Herring, 2000). A presence abroad is therefore linked to some form of foreign control over local firms and thus the two facets of globalization are inter-linked.

While this chapter deals explicitly with 'globalization', it also has implications for urbanization. As will be seen, foreign presence in a local firm is inextricably connected with a metropolitan location and invariably this is the Tel Aviv metropolitan region. As such, globalization processes under-pin processes of urbanization and metropolitan growth and expansion. The life-style and housing choices of many of the employees of the more advanced sectors of the Israeli economy, that have attracted a foreign presence, make for increasing pressure on the metropolitan land market. Firms decentralize to outer-metropolitan industrial parks and demand for suburban living means increasing consumption of land and expansion of the metropolitan area. As such, globalization finds expression in urbanization and metropolitan expansion.

The aim of this chapter is to suggest a stylized process by which foreign investment enters an emerging node economy, its impact on metropolitan growth and the way in which the node is integrated with the world economy through these two processes. Due to limits of data availability, our analysis will be confined to investigating those processes for which we have been able to collect empirical data. We are aware of the sterility of the term 'foreign direct investment' and of the fact that a foreign presence in a local firm can be expressed in a multitude of new forms of contractual arrangements. These include arrangements such as research and marketing agreements, limited partnerships, OEM agreements, joint ventures, licensing and franchising and the like. However, we do not have detailed data on all

these forms of foreign presence. We therefore supplement our aggregate findings with some more qualitative information on these new forms of contractual arrangements but this remains at most, anecdotal.

A major hypothesis underlying our approach is that the motives for a foreign presence in a node economy characterized by high tech industry and sophisticated services are very different to those 'classic' factors that characterized FDI in the past. While incentives, cheap labor, infrastructure investment and good labor relations are all part of the collective wisdom as to what attracts foreign investment, our approach is that these factors are much less relevant when it comes to a node economy characterized by technologically advanced activities. Investigating this hypothesis means focusing special attention on the high technology and advanced financial services sectors and in the analysis, these activities merit special attention. The nature of the Tel Aviv high technology economy is also dealt with separately (see Chapter 6). In place of the traditional FDI-inducing factors, we posit a variety of alternative motives that attract FDI. These include, the presence of small firms, the presence of considerable R&D activity in these companies, the relative employment stability of highly skilled labor in these firms and so on. Again, our data do not always allow us the direct measurement of these factors but our results at least allow for drawing conclusions by implication, with respect to this hypothesis.

In the sections that follow, we outline the theoretical and conceptual background on the emergence of a 'node'-type economy and the way FDI is a part of this process. We then describe the process of foreign investment in the Israeli economy from the beginning of the 1990's analyzing the trends and exploring some of the motives and anomalies in the behavior of Israeli firms that seek foreign investment abroad. Following-on from that we will present a simple model of the process of foreign investment as a two-stage (nested) process. This can be viewed conceptually and modeled empirically as either an hierarchical structure, in which the decision to invest abroad and the scope of this investment are executed first followed by the locational decision, which in our case is a binary or categorical choice. Alternatively, the process can be modeled as a simultaneous system where the output of one decision becomes the input to another. The data sources and main variables are then presented as a prelude to the discussion of the empirical findings.

4.2 FDI AS A STRATEGIC CHOICE

A voluminous literature exists on the motivations for foreign direct investment (FDI). Much of this evidence points to factors such as the size of the local market, the existence of incentives, the presence of cheap labor and the union climate as determinants of FDI (Glickman and Woodward, 1989; Dicken and Quevit, 1994). This literature puts the stress on the behavior and motives of the investing companies. Less attention has been focused on the behavior of the companies that are the object of this investment. They are assumed to be the passive recipients of externally dictated events. This chapter suggests that in the case of a node economy looking to break into global markets, becoming the object of FDI (i.e. facilitating

whole or partial acquisition by foreign interests), might be a strategic choice (Chapman, 1999; Dicken, 2000).

This is a very different perspective on FDI, to the view traditionally taken. It implies that the imperatives of globalization are encouraging a new form of firm behavior. The volume of foreign investment in a domestic economy is one manifestation of the existence of global networks. The traditional form this takes is through the 'classic' FDI route; i.e. foreign companies acquiring shares in domestic producers. This can lead to either horizontal or vertical integration between the foreign and the domestic interests (Dunning, 1993). Another route to integrating in global networks is through forging shorter-term alliances with foreign interests such as OEM agreements, joint R&D collaborations, limited partnerships, franchises, marketing agreements and the like. This gives rise to 'diagonal integration' between the domestic and the foreign companies (Ahern, 1993). A further strategy for breaking into global networks, and the focus of the present chapter, is for local firms to actively look to FDI (via direct investment, portfolio investment, mergers and acquisitions, venture capital investments etc) as a route to integration into the global economy. While in terms of national accounts this is no different to 'classic' FDI, from a network perspective, its' significance is rather revealing.

This form of behavior is often used as an active strategy consciously pursed by firms in high-risk sectors where market visibility is paramount. For example, recent research from Israel suggests that high technology companies that are largely unknown in the market will issue offerings abroad as a 'signaling' strategy (Blass and Yafeh, 2001, see also Chapter 6). This way they indicate to markets and investors that they should be taken seriously. These firms often face the well-know 'Macmillan Gap' that faces small high risk firms i.e. the trade off between relinquishing control and raising capital. By encouraging foreign investment, the firm may have to forfeit some control but is gaining global investor recognition in the process.

This behavior also calls into question the classic rational for FDI. Foreign investment in domestic firms in this instance is not a result of local cheap labor pools or incentives. Rather, FDI prompted by the desire to enter global networks, presupposes a very different rationale. Earlier work has suggested that this form of investment is attracted to a country like Israel because of factors such as the relative stability of local high skilled labor and the concentration of R&D in small firms (Felsenstein, 1997). This is taken to indicate that the local economy is playing a node-type role in global networks.

A similar trend is discernible in with respect to other economies where the need to establish a high tech presence in foreign markets, is acute. In the Canadian economy for example, while inward investment has traditionally been dominated by the establishment of branch plants of large multinationals operating in primary production, since the early 1990's a new trend has emerged. This is characterized by a shift towards higher value-added, technology-based inward investment and by mergers and equity holdings rather than new plant construction (MacPherson, 1996). In terms of volume of inward investments, acquisitions and stock issue accounted for nearly 90 of all foreign investment activity which totaled over $8bn in 1990. Canadian-based foreign controlled firms account for the majority of inward

investments and are more likely to be in advanced, high value-added sectors than inward investment stemming from other sources (McNaughton, 1992). Like the experience of the Israeli high technology sector, the growing importance of technology intensive exports means that Canadian firms are looking to financial institutions in the US (such as NASDAQ) as both a source of capital and international recognition. For Canadian small and mid-sized high-tech firms this is of particular importance as capital constraints put them at a disadvantage with respect to foreign high tech plants operating in Canada (Britton, 1996).

In the case of the UK, the case has been made that local firms and institutions use multi-national investment in the local or regional economy as a method for linking into complementary but geographically distant networks. Cantwell and Iammarino (2000) show a self-perpetuating and symbiotic relationship in the pattern of multinational R&D investments in UK regions. This FDI seeks out particular places with pre-existing technological advantages. Once rooted in these places, FDI further serves to enhance local competences, endogenizing the growth dynamic and making select locations even more attractive to further rounds of investment.

4.3 SURVEYING RECENT TRENDS IN FOREIGN INVESTMENT IN ISRAELI INDUSTRY

This analysis charts the growth in foreign presence in the Israeli economy since the early 1990's using annual aggregate data published by the Controller for Foreign Currency at the Bank of Israel. FDI (defined as a 5 percent controlling interest in real (asset-based) investment) as a percentage of industrial investment has grown from an average of 1-1.5 percent at the start of the decade to 7-8 percent today. Until the early 1990's, the combination of geo-political instability and small market-size were probably the main factors explaining the limited foreign interest, although empirically, the former has been shown to be less of a potent factor in explaining US overseas investments, than commonly imagined (Thrall, 1984). This fast rate of growth over the last decade, has allowed Israel to start approaching FDI volumes in other comparable similar sized countries such as Holland, Denmark and Belgium, where FDI shares of 9-10 percent are commonplace (Chapman, 1999). The dollar volume of this activity however is limited. At the beginning of the decade, foreign direct investment was less $500m. It only reached a plateau of over $1bn in the second half of the 1990's when the first fruits of the 'peace dividend', the liberalization of local capital markets, deregulation and structural reform in local markets and the growth of the high tech boom, began to simultaneously materialize. FDI grew to $1.8bn in 1998, $2.8bn in 1999 and to $4.4bn in 2000 (Bank of Israel, 2000) (Figure 4.1). In parallel, foreign investment in listed securities portfolios (which is not included in our strict definition of foreign 'direct' investment) also increased, from roughly $0.3bn at the beginning of the decade to $2.5bn in 1998 and $4.0bn in 2000. However, the combination of the worldwide economic slowdown plus a worsening security situation in Israel brought a stark turnaround in these trends in 2001 with direct foreign investment shrinking by 34 percent to a total of $2.7bn.

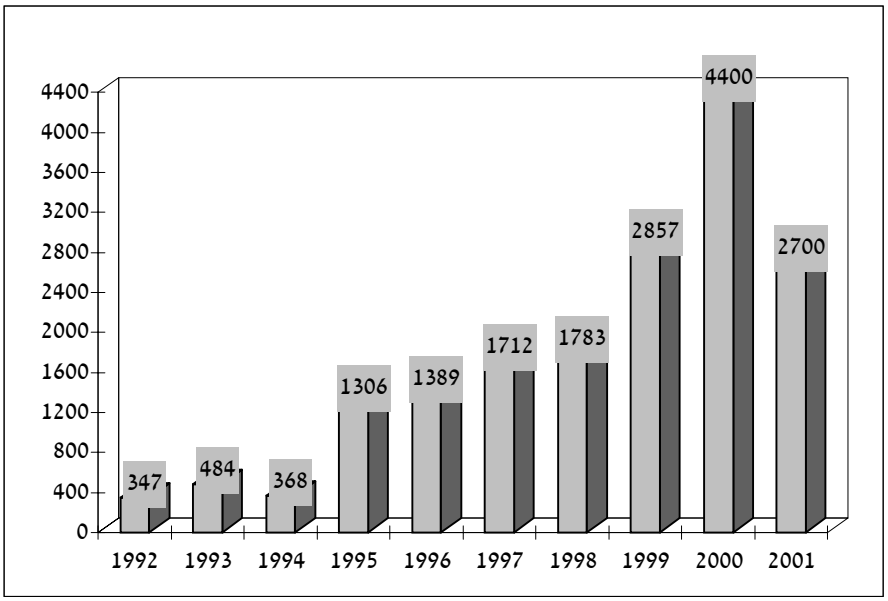

Figure 4.1 Foreign direct investment in Israel, 1990-1999

FDI-generated employment however, is of a smaller magnitude as much foreign interest is in small and new local research-based firms rather than in production-based branch plants. Thus, while the economies of countries such as Belgium, Scotland and Singapore look to FDI as an important employment generator (accounting for 33 percent, 34 percent and 51 percent of total employment in the respective economies), in Israel FDI presence probably accounts for less than 10-12 percent of all employment.

One particularly salient feature of the growth of foreign investment in Israel over the second half of the 1990's has been that related to the activities of high technology companies, The popular perception of FDI is that of foreign capital seeking out opportunities for investment in Israeli high technology. In terms of the number of FDI-based transactions, this image probably reflects reality. However in terms of the magnitude of the volume of investment, the limited data available shows that this perception is unrepresentative. Figure 4.2 shows a gross sectoral breakdown of FDI in Israel over the period 1995-7. This is the only time period for which sectoral data of foreign investment is available. Comparing high tech (electronics, software and telecommunications) with non-high tech (all other sectors) illustrates clearly that over this period, the majority of foreign investment was aimed at the non-high tech sectors. This aggregate picture is supported by evidence from individual transactions.

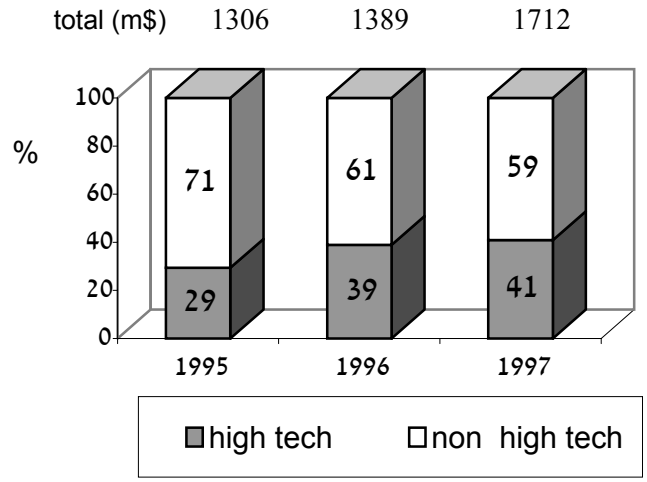

Figure 4.2 Percentage of foreign direct investment in high tech, 1995-1997

Much of the aggregate growth in FDI since the mid-1990's has been due to a few large transactions in the area of mergers and acquisitions (M&A). For example, in 1995 the majority of foreign investment in the local economy was due to foreign acquisitions of a 40 percent controlling interest in the Koor Industrial group, a 20 percent interest in Bezek telecommunications company, 15 percent in Israel Chemicals and the sale of the Lannet communications corporation (to Lucent Technologies). 1996 was characterized by just one large transaction that accounted for the majority of the volume of FDI that year: the Nestle corporation's acquisition of a part of the Osem food group. In 1997, the 2 major foreign investments were in the financial services sector with the sale of 25 percent of Bank Hapoalim to a US investor and 60 percent of the Migdal insurance company to Generali. In 1998, much of the pattern of FDI was further consolidation of foreign presence in corporations that already had some foreign control. Only 7 investments were above the $30m mark. However in the first half of 1999, a flurry of M&A activity saw nearly one dozen Israeli high tech companies being acquired by US firms culminating with Lucent Technologies paying an hitherto unprecedented sum of nearly $4.8bn for a small Israeli optical networking start-up called Chromatis Networks. This sum was equivalent in value to nearly 5 percent of gross national product.

The local acquisition of foreign high technology corporations is a relatively new phenomenon that started in the second half of the 1990s. Prior to the Lucent-Chromatics acquisition, a series of global US high technology corporations entered the local economy through buy-outs of small Israeli high tech firms. This activity has resulted in the arrival of corporations such as Johnson and Johnson (who acquired a local firm called Biosense), America-On-Line (Mirabeles), BMC (New Dimension), Lucent Technologies (Lannet), General Electric (Elscint MRI),

Platinum (Memko) Texas Instruments (Butterfly), Sunguard (Oshap Technologies), US Robotics (Scorpio) and so on. Aside from the symbolic significance of the presence of these global corporations in the local economy, much of the profile of this presence is due to the (unprecedented) magnitude of the sales that have accompanied this entry. Prior to the Chromatics buy-out, small, unknown and unproven local firms had been sold for much smaller sums (themselves of hitherto unknown proportions) such as the case of AOL's acquisition of Mirabeles for $400m the BMC acquisition of New Dimension for $675m.

In the light of these developments, it is easy to appreciate the source of the popular image of high-tech driven foreign investment in the local economy. A series of high-profile acquisitions of small local high tech firms has brought some large global high technology corporations to Israel. More importantly however, a second source is the increasing tendency of local high technology firms to raise capital abroad. Over the longer term, this is also probably a more significant trend as well.

Israeli companies that raise capital abroad, specifically on the NASDAQ stock market, comprise the second largest presence after Canadian firms with nearly 80 firms traded. This is a trend that can be traced to the beginning of the decade. Figure 4.3 illustrates that this aspect of globalization has been exclusively driven by high tech companies. They consistently account for over 60 percent of all capital raised abroad. The slowdown registered for 1998 simply reflects the lower level of stock market activity worldwide precipitated by the South East Asian crisis. As a result many planned stock issues were frozen by Israeli firms.

Research undertaken at the Bank of Israel (Blass and Yafeh, 2001) indicates that those local firms raising capital abroad are on average more technology and innovation oriented, younger and more innovative than firms raising capital locally. Yet, the tendency to raise funds on international markets has not been spurred by the price or availability of local capital. In many instances trading abroad can be a more expensive prospect than trading locally. In addition there has hardly been a shortage of local investment capital locally over the last few years. In 1996 the volume of capital raised abroad was only two-thirds of that raised locally and only one-third in 1997.

This tendency to trade abroad must be more than just a function of access to capital and its relative price. It could indicate a 'signaling' or 'positioning' strategy whereby small firms with little market credibility use the option of trading abroad in order to gain market visibility (Appold, 1991; Blass and Yafeh, 2001). This is very important for firms that are new and unknown. A mature market like that of the US is used as a testing ground for evaluating firms with few tangible assets and little track record. This suggests a very different rationale for foreign investment and for the entry of US firms into the local market, than generally suggested.

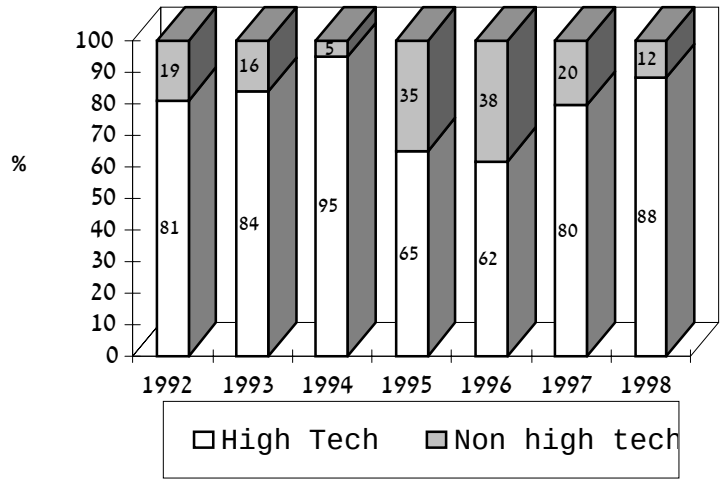

Figure 4.3 Percentage of capital raised abroad, 1992-1998

At this stage, this hypothesis remains purely speculative. It is tested below in Chapter 6 where an analysis of Israeli high tech firms is presented. This will contrast the characteristics of those high tech firms that trade locally with those that trade abroad. A significant difference between these two groups should shed some light on why Israeli firms are looking to global markets for investment and on the functioning of a (high tech) node economy in a global system. In turn this should also provide some support for the basic contention relating to the very different motivations for FDI with respect to a node economy.

Finally, foreign direct investment can also manifest itself in the form of venture capital activity. Again, in this area, the main developments have occurred since the second half of the 1990s and have been linked to the development of the local high tech economy. From a situation of zero venture capital presence in 1990, venture capital investment rose to $1.6bn in 1999 and to over 3.0bn in 2000, with 80 percent of this coming from foreign sources (Jerusalem Post, 2000). This volume of investment ranked Israel in 10th place worldwide with over 100 funds (both Israeli and foreign) operating in the local market. The worldwide recession that followed, saw this volume shrink to $1.25bn in 2001.

4.4 MODELING THE FOREIGN INVESTMENT AND LOCATION DECISIONS

Our basic framework sees the foreign investment decision process as three-staged (Figure 4.4). The first stage relates to the basic decision to invest in a foreign market. Once that decision has been executed, the magnitude of the foreign investment is considered. Many firms change this volume (upwards and downwards) over time after the initial strategic decision regarding foreign investment has been

made. The third stage in the decision process relates to the actual place of investment in the target location.

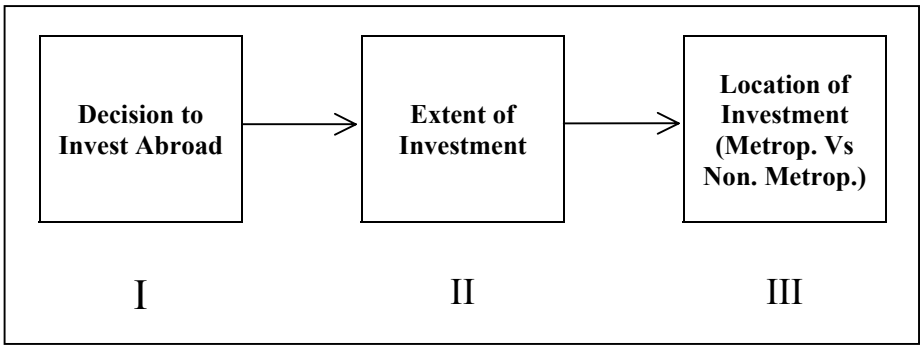

Figure 4.4 FDI and metropolitan location: the basic framework

These three stages can be linked in a causal framework. This suggests that each stage in the decision process is affected by the stage that preceded it. In addition, each stage is influenced directly and indirectly by a series of characteristics that describe firm age, size, sector and markets. The direct and indirect effect of these determinants can be estimated at each stage. This schema is presented as a simple path model in Figure 4.5. In this model, the system of equations has an underlying casual structure. Path modeling involves estimating path coefficients (standardized beta values) and on this basis calculating direct and indirect causal effects using the standard multiplication rule (Duncan, 1975).

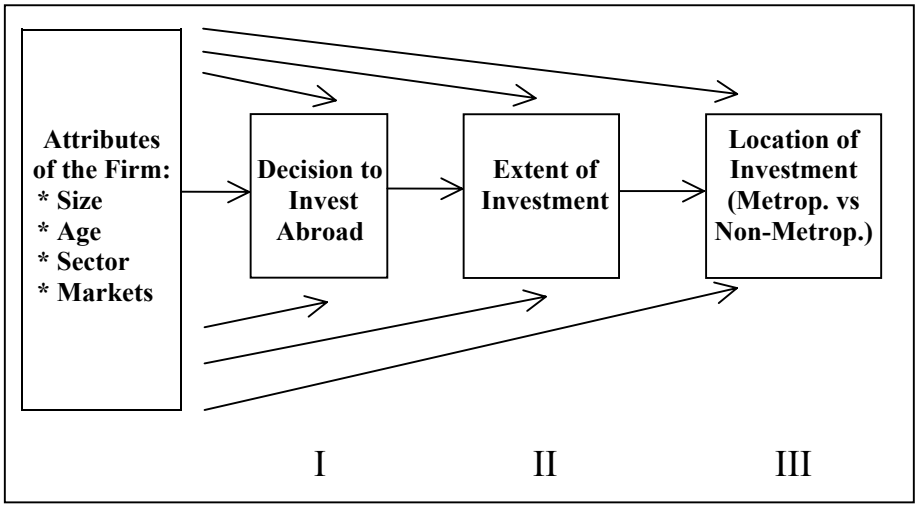

Figure 4.5 FDI and metropolitan location: a framework for analysis

More formally, the causal framework presented above can be estimated as a series of structural equations. We begin with the basic premise that a firm will attempt to maximize utility. This can be achieved through pure business decisions such as those relating to the decision to invest abroad or through spatial-business decisions such as those related to locational choice. For example, the utility function of the firm from a metropolitan location, *m*, will be;

$$U_m = f( ) + e_m \tag{4.1}$$

where $f( )$ is the form of the utility function and e_m is a random error term. Assuming we know something about the form of f (e.g. location is contingent on firm size, sector, age and other firm characteristics), then our assumptions regarding the distribution of the error term become of prime importance. If we assume that the e_m's are independent of each other and Weibull-distributed, we are assuming a probability choice in which selection of location choice, *m,* out of the whole set of choices, *n,* is expressed by the general form;

$$P_{\mathrm{m}} = \exp \mathrm{f}_m ( ) / \Sigma_1^n \exp \mathrm{f}_n ( ) \tag{4.2}$$

This is of course a logit specification and is equally applicable to the basic decision to invest abroad or not. However, in the case of a hierarchy of choices in which the location choice is a lower-order choice that is taken after some more basic choice, in our case the decision to invest abroad or not, then a slightly different expression is needed. In this tree-like structure, the decision where to locate branches-out from the decision to invest abroad. In other words, the two decision choices are linked. In the first instance we have to estimate the probability of location for example in a metropolitan location, *m*, given the more basic decision to invest abroad, *t*, as follows;

$$P_{m|t} = \exp(\mathrm{k}_m + \mathrm{k}_{tm}) / \Sigma_1^{m^*} \exp (\mathrm{k}_m^* + \mathrm{k}_{tm}^*) \tag{4.3}$$

The terms k_m and k_t represent the components of the utility terms in the location and foreign investment decisions respectively, while the term k_{tm} denotes those components that are common to both levels in the decision hierarchy. For the foreign investment choice, the marginal probabilities are represented as;

$$P_{\mathrm{t}} = \exp(\mathrm{k}_t + \mathrm{b}\ \mathrm{U}'_t) / \Sigma_1^{t^*} \exp (\mathrm{k}_t^* + \mathrm{b}\ \mathrm{U}'^*_t) \tag{4.4}$$

where,

$$\mathrm{U}'_{\mathrm{t}} = \log \Sigma_1^{m^*} \exp (\mathrm{k}_m^* + \mathrm{k}_{tm}^*) \tag{4.5}$$

The assumption here is that at each stage of the decision process, the expected utility already accounts for the utility derived from earlier decisions. Thus the decision regarding the magnitude of foreign investment abroad accounts for the

more basic binary choice of whether to invest abroad or not. Similarly, the decision to invest abroad and the volume of this investment is already accounted for in the expected utility from the location decision (e.g. metropolitan, small town, peripheral area etc). The size of the *b* parameter will affect the results. Assuming a value of $b \approx 1$ will allow us to estimate the above equations as a regular logit model.

The actual estimation method involves dealing with a 'mixed' system (Wrigley and Brouwer, 1986) where two dependent variables are categorical (the decision to invest abroad and the decision to choose a metropolitan location), while the other is continuous (volume of FDI). This necessitates the following stages of analysis:

Estimating the probability of investing abroad: the regression coefficients in this instance are logits and are thus not directly interpretable unless reported in probabilistic terms (ΔP). These probabilities can be interpreted as illustrating the probability of change in the dependent variable at the mean (i.e. in the likelihood of foreign ownership), due to one unit change in the independent variable[1]. Four our purposes however, these probabilities also represent some of the indirect effects on the decision to choose a metropolitan location.

Estimating the volume of the investment abroad: this is done by OLS regression with the standardized regression coefficients (β values) representing the indirect effects. These serve as inputs for calculating the indirect effects on location of foreign direction investment in the next stage. Indirect effects are derived by applying the standard multiplication rule to the regression coefficients (Duncan, 1975).

Estimating the probability of locating in metropolitan Tel Aviv: the effects of all the variables on this decision are then estimated. These represent the direct effects on the decision choice. As above, the probability changes (ΔP) represent the predicted changes in probability at the mean, given a unit change for continuous independent variables or a categorical change for nominal independent variables. These coefficients along with the indirect effects estimated at the previous stages allow for a comprehensive picture of both the direct and indirect effects on the probability of metropolitan locational choice given the prior decision to invest abroad.

This form of structural equation modeling based on path analysis estimation couched in probability terms has been used in the sociology and organization science literature (see for example Palmer *et al.*, 1987). It has been less utilized as a method for modeling industrial location and foreign investment decisions in economic geography despite the popularity of discrete choice modeling as an explanatory framework for both FDI and location studies (Ondrich and Wasyklenko, 1993; Felsenstein, 1996; Frenkel, 2001).

4.5 DATA SOURCES AND VARIABLES

The data source for this analysis is a composite file constructed from the Registrar of Companies (Ministry of Justice) data base and augmented by Dun and Bradstreet firm-level data. The former source gives a unique cross-sectional picture of the ownership structure of companies at one moment in time. The file includes details as to the form of ownership, e.g. regular shares, management shares, an identifier as to whether the shares are foreign owned but very little data on the company itself. In

addition, records are compiled by foreign-owner. Thus a company with multiple foreign ownership will appear more than once. In principle, firms that have ceased operation are meant to report to the Registrar. In practice, they do not and thus many records are simply in active. Furthermore there is little way of distinguishing 'fictitious' companies (established for tax purposes), from real trading entities. The Dun and Bradstreet file augments the above source. While it does not include any details on foreign ownership it does provide general information at the establishment level such as year of foundation, activity, employees, sales, exports etc.

In principle, we analyze the data in four ways. The full data set (that is used for modeling the foreign investment and locational decisions) comprises 2595 observations. This is sub-divided into three further data sets that are used for the statistical descriptions below: data describing foreign owned firms only (819 observations), data describing metropolitan Tel Aviv firms only (1469 observations) and data relating to Tel Aviv foreign-owned firms (452 observations)

The main variables are as follows:

The Existence of Foreign Ownership (FOROWN); this is a binary variable whose source is the Registrar of Companies (Ministry of Justice).

Percentage Foreign Ownership (PERFO); a continuous (censored) variable: this comes from the Registrar of Companies (Ministry of Justice) and relates to the level of foreign ownership in March 1997.

AGE: this continuous variable relates to firm vintage in years. The source is as above, supplemented by data from DunsDisc 1997 (Dun and Bradstreet).

SALES: this continuous variable measures firm size and relates to sales in $m in 1996. The source is DunsDisc 1997.

EXPORTS: a continuous variable describing the company's market orientation and relating to exports ($m) in 1996. The source is DunsDisc 1997.

EMPLOYEES: this continuous variable also measures firm size and relates to the number of full-time employees in 1996. The source is DunsDisc 1997.

Location (MLOC): this binary variable relates to the firms' main location in metropolitan Tel Aviv (Tel Aviv and Central districts). The source is the Registrar of Companies data supplemented by DunsDisc.

Principal economic sector (HIGH TECH): this binary variable relates to whether the firm operates in a high-technology production, research or financial services sector. The source is the Registrar of Companies data supplemented by DunsDisc.

4.6 EMPIRICAL RESULTS

4.6.1 Frequency Distributions

The first task in the empirical analysis is simply to describe the distribution of the data set. To this end, we 'cut' the data according to a series of cross-sections as follows:

All Firms: description of all the firms for which we have information, irrespective of location or extent of foreign ownership

Foreign Owned Firms: this refers to all firms having some foreign ownership, irrespective of location.
Firms Located in Tel Aviv: this relates to all firms in the Tel Aviv metropolitan area, ignoring the presence of foreign ownership.
Tel Aviv Foreign Owned Firms: this is a small sub-set of firms that are both located in the Tel Aviv region and have foreign ownership.
Tel Aviv Non-Foreign Owned Firms: are located in Tel Aviv but without any foreign presence.

Table 4.1 shows the simple geography and the spatial pattern of the foreign ownership structure of the firms. As can be seen, the overwhelming majority of firms are located in the Tel Aviv region (65 percent) and within the city of Tel Aviv itself (53 percent). Foreign-owned establishments are slightly more pronounced, with 68 percent in the Tel Aviv metropolitan area and 54 percent in the city. It should be noted that the construction of this data set has resulted in an a priori over representation of the larger firms in the Israeli economy and thus the predominance of Tel Aviv and the Central region, is hardly surprising.

Table 4.1 Frequency distributions - all firms by location (district) and presence of foreign ownership

Ownership	*Jerusalem*	*North*	*Haifa*	*Center*	*Tel Aviv*	*South*
All Firms (n=2599)	173	202	215	288	1392	105
Foreign Owned (n=825)	81	78	63	105	452	45

Taking just the firms in the Tel Aviv metropolitan area (Tel Aviv and Central districts), we find that one third have some form of foreign presence. Proportionately, this presence is slightly greater in the Central area (37 percent) than in the Tel Aviv area (33 percent). However the absolute volume of firms in Tel Aviv dwarfs all the other areas combined.

Table 4.2 Frequency distributions - firms located in Tel Aviv and Central districts by presence of foreign ownership

	Tel Aviv	*Center*	*TOTAL*
Foreign Owned Firms	452	105	557
Non Foreign Owned Firms	940	174	1114
TOTAL	1392	279	1671

A sectoral breakdown of the data by the various cross-sections is presented in Table 4.3. In terms of absolute representation in the data, the commerce branch is the largest activity accounting for 26 percent of all firms and 29 percent of all the Tel Aviv firms. In this sector, overall 36 percent of establishments have some form

of foreign presence although in Tel Aviv this proportion is somewhat lower (29 percent).

Financial services form one of the dominant activities of any large metropolitan area and Tel Aviv is no exception. In our data, financial services establishments account for 20 percent of all firms and for a similar proportion in the sub-set of Tel Aviv firms. Foreign presence in this industry is represented in 29 percent of all firms and in 25 percent of Tel Aviv establishments. It should be noted that these figures are based on establishment counts and still say nothing about numbers employed. It is reasonable to assume that in Tel Aviv this industry is a substantial employer (in the banking, insurance, finance and real estate industries) above the relative size of this sector when measured by the number of establishments.

For our purposes, the high tech sector is of particular importance in view of its' agglomerative and metropolitan locational tendencies the extent of foreign presence in this sector. While high tech establishments represent less than 7 percent of the firms in our data set (bearing in mind the bias toward large firms), 86 percent of these have some foreign ownership. In the Tel Aviv area, this proportion is hardly less pronounced and stands at over 80 percent. In total, 63 percent of the high tech firms are located in metropolitan Tel Aviv. These figures underscore both the role of FDI as a gateway to international networks and the limited spatial dispersal, characteristic of this industry.

As to be expected, both foreign presence and spatial agglomeration in Tel Aviv are much less prevalent in the low tech, transport and construction sectors. While Tel Aviv dominance in all these sectors is less pronounced, the sheer volume of population in the metropolitan area means that the proportion of firms in the Tel Aviv region is still large (for example in the private services and transportation sectors). Some of this concentration could also be due to the fact that in certain cases we have not been able to disengage the firm from its various establishments leading to an over-representation of Tel Aviv where many firms are head-quartered.

Table 4.3 Frequency distributions - all firms by economic activity, location in Tel Aviv and presence of foreign ownership

Economic Activity:	*All Firms (n=2599)*	*Foreign Owned (n=825)*	*Tel Aviv (n=1582)*	*Tel Aviv Foreign Owned (n=452)*	*Tel Aviv Non Foreign Owned (n=1130)*
Commerce	670	239	458	136	322
Construction	240	27	137	12	125
Financial Services	410	122	324	83	241
High Tech.	170	146	109	88	21
Low Tech	527	111	213	45	168
Private Services	232	58	160	29	131
Public services	158	35	57	17	40
Transport	134	34	95	17	78

Looking at the various cross-sections by age structure that differentiates new from old firms (Table 4.4), we see that foreign ownership is proportionately more prominent in newer firms than in older firms. For all the firms, roughly one quarter have been established post-1990. However for those with foreign ownership the share is 42 percent. These proportions are repeated when Tel Aviv is taken as the focus. For all Tel Aviv firms, the share of new firms stands at 23 percent. For those Tel Aviv firms with foreign ownership it stands at 38 percent.

Table 4.4 Frequency distributions - all firms by age structure, location in Tel Aviv and presence of foreign ownership

Firm Attributes	*All Firms (n=2599)*	*Foreign Owned (n=825)*	*Tel Aviv (n=1582)*	*Tel Aviv Foreign Owned (n=452)*	*Tel Aviv Non Foreign Owned (n=1130)*
Firm Age:					
Established Before 1990	1942	480	1210	281	929
Established After 1990	657	345	372	171	201
Firm Size (no. Employees):	1433	575	904	309	595
Less the 100 employees	1166	250	678	143	535
More than 100 employees					
Volume of Sales ($m1996):	2207	743	1286	395	891
Sales > $100m, 1996	392	82	296	57	239
Sales < $200m, 1996	2374	776	1407	416	991
Sales > $200m, 1996	225	49	175	36	139

The bias of the firm size distribution in the data set is immediately apparent (Table 4.4). Medium and large firms comprise nearly 45 percent of the surveyed firms, while their share of the total firms population in reality is rather smaller. While large firms are knowingly over-represented, when firm size is cross-tabulated with foreign ownership and location we can see that a disproportionately large number of small firms have some form of foreign presence (70 percent). This figure is repeated when we observe the Tel Aviv firms with foreign ownership. In this instance, their share reaches 68 percent while the share of small firms in all the Tel Aviv firms is somewhat lower (57 percent).

Sales volume is another measure of firm size. Here unfortunately our data is much more patchy, especially with respect to the firms with foreign ownership that are usually, smaller, newer and more high-tech oriented (see above). The distributions in Table 4.4 point to the fact that sales volumes are lower for firms with a foreign presence than for the others. While overall, only 15 percent of firms have sales in excess of $100m and 9 percent in excess of $200m, when firms with foreign ownership are separated out, this proportion drops to 10 percent and 6 percent

respectively. When Tel Aviv firms are considered alone, the proportions are slightly higher than for all firms (19 percent and 11 percent respectively). Subsequently, when Tel Aviv firms with foreign ownership are extracted from the rest of the Tel Aviv establishments, the figures are correspondingly higher than for all firms with foreign presence (12 percent and 8 percent respectively). While Tel Aviv seems to be the repository for the newer, smaller and generally more high tech firms, when size is measured in terms of sales volume these firms would seem to be above average (see difference-of-means tests below, for statistical confirmation or rejection).

4.6.2 Descriptive Statistical Testing

We now focus on some descriptive statistics and some tests of univariate relationships between variables in order to lend some statistical weight to elementary hypothesis regarding firm attributes and their relationship to location and foreign ownership. Using the same cross-sections of the data set as above, the means and standard deviations of the continuous variables are presented in Table 4.5.

With respect to percentage foreign ownership, the average for all firms is 11 percent and for those firms with a foreign presence (one third of all firms) this figure stands at 36 percent. The corresponding figure for Tel Aviv firms with foreign ownership stands slightly lower at 33 percent. The data in Table 4.5 also serves to reiterate the fact that on average, firms with foreign ownership are smaller in employment terms and newer in age. However in this instance, even the average firm is quite large (300+ employees) due to the effect of the very large firms on the mean. The median might have been a better indicator in this case.

Table 4.5 Means and standard deviations (in parentheses) for firm attributes, by location in Tel Aviv and presence of foreign ownership

Firm Attributes	*All Firms (n=2595)*	*Foreign Owned (n=819)*	*Tel Aviv (n=1469)*	*Tel Aviv Foreign Owned (n=414)*	*Tel Aviv Non Foreign Owned (n=1130)*
Percentage Foreign Ownership, 1997	11.4 (25)	35.8 (32.9)	9.3 (22.7)	33.2 (32.2)	0 (0)
Sales (M $, 1996)	106.9 (523.6)	178.7 (108.5)	132.6 (612.2)	184.1 (80.5)	246.8 (1662)
Exports (M $, 1996)	17.4 (93)	40.3 (157)	14.4 (82)	37.3 (148)	5.8 (25)
Firm Age (yrs.)	21.4 (16.0)	14.5 (12.8)	21.3 (16.0)	13.8 (12.1)	20.2 (18.4)
No. Employees	351.5 (1215)	276 (1236)	374 (1330)	312 (1466)	515 (2423)

A major discrepancy should be noted with respect to firms' sales and exports. In this instance, missing values for many of the firms with foreign ownership that were identified through the Registrar of Companies but did not exist on the D&B database, has caused these rather unusual averages. While the export figures are plausible, there may be some bias in the sales figures.

The next logical step in the analysis is to run a series of difference-of-means tests in which the above continuous variables are the dependent variables and various categorical attributes of the firm (size, location, age structure, foreign ownership structure and type of economic activity), are the independent variables. Table 4.6 illustrates the results of this kind of statistical testing which is performed on the same cross-sections of the data that have served the analysis this far. The top panel in that table shows that however one cuts the data, the size categories of greater or less than 100 employees seems to represent a real breaking point in terms of firm performance. With very few exceptions, a statistically significant difference seems to consistently emerge between large and small firms across all the firm attributes (age, sales, export and percentage foreign holding). It should be noted that in the absence of the reporting of individual category means, will still cannot ascertain exactly where these differences lie: for example, just how different the average small and large firms are with respect to age. All we can say at this juncture is that they are statistically different.

The second panel in Table 4.6 looks at differences across the firm attributes with respect to location. In this case only two cross-sections of the data are considered (any separation of Tel Aviv from the rest of the data would be meaningless) and the categorical variable is location in the Tel Aviv metropolitan region or location elsewhere. With respect to all firms, we can say that across most attributes, significant differences do emerge between Tel Aviv and non-Tel Aviv firms. However, when taking only the firms with foreign ownership, none of these differences can be upheld. Foreign-owned firms in Tel Aviv do not seem to be significantly different to foreign owned firms elsewhere with respect to age, sales, exports and percentage foreign holdings.

The 'young' versus 'old' firm dichotomy is tested in the third panel of Table 4.6. The results however are not unequivocal. With respect to firm size, it would seem that there is a major difference between young and old firms, however the data is divided. With respect to the other attributes, the evidence is less consistent. Sales volume does seem to be related to firms' age, while export volume does not.

When foreign ownership structure is divided into three categories (less than 20 percent, 21-50 percent and more the 50 percent), a consistent and significant different emerges across these categories with respect to firm age and firm size (employees). This is reflected in the fourth panel of Table 4.6. However, this difference is not replicated when volume of sales and exports are considered (which are also indicators of firm size). The volatility of the latter variables has been noted above. Thus it is hard to determine whether this lack of significant difference across ownership categories is a substantive finding or one resulting from technical problems associated with these variables.

Table 4.6 Difference-of-means tests: attributes of firms by size, location, age structure and ownership structure (f-values)

	Dependent Variables			
	Firm Age (years)	*Sales ($m 1996)*	*Exports ($m 1996)*	*Percent Foreign Ownership*
Firm Size[1]				
Overall Mean	21.4	106.9	17.4	11.4
Foreign Owned (F.O.)	226.4**	24.9**	8.5*	19.3**
Tel Aviv	1.9	4.9*	4.0*	37.8**
Tel Aviv F.O.	106.7**	24.2**	6.5*	10.4**
Location[2]				
All Firms	8.5*	5.4*	1.4	19.8**
Foreign Owned	1.8	0.05	1.4	10.2**
Age Structure[3]				
Foreign Owned	–	3.3*	2.6	0.005
Tel Aviv	–	5.4*	0.9	28.4**
Tel Aviv F.O.	–	1.8	2.1	1.3
Foreign Ownership Structure[4]				
Foreign Owned	4.9**	2.1	1.1	–
Tel Aviv	2.4*	1.9	0.09	–
Tel Aviv F.O.	2.7*	1.2	1.3	–
Economic Activity[5]				
Foreign Owned	0.009	0.09	4.5*	3.0*
Tel Aviv	0.6	11.7**	5.9*	8.9*
Tel Aviv F.O.	0.6	0.01	3.4	1.1

* α significant at $p < .05$ ** α significant at $p < .001$

1. Firm Size categories: < 100 employees; > 100 employees
2. Location categories: Tel Aviv; elsewhere
3. Firm Age categories: Before 1990; After 1990
4. Foreign Ownership categories: 1-20 percent; 21-50 percent; >51 percent
5. Economic Activity categories: high tech and financial services; other activities

The high-tech and financial services firms are separated from all the others and comparisons are run between these two categories across the various firm attributes (Table 4.6, fifth panel). While significant differences do emerge with respect to exports and sales, we cannot state that there is any significant difference between the two groups with respect to firm age, size and percentage foreign ownership. Thus, the tentative image of the smaller, younger more high tech firm with a higher level of foreign ownership that seemed to emerge from the frequency distributions cannot be fully upheld on the basis of these results. The pattern is not as 'clean' and consistent as we had hypothesized.

4.6.3 Modeling the Investment and Location Decisions

The correlations amongst all the variables are presented in Table 4.7. These bivariate relations suggest a strong relationship between the extent of foreign investment and smaller, newer, firms with an orientation to exports, high tech and metropolitan location. Employees and sales are strongly related suggesting that only one of these should be used as an explanatory variable. Location in metropolitan Tel Aviv would seem to be significantly related to the extent of foreign control and the magnitude of sales and exports.

Table 4.7 Descriptive statistics and correlations amongst the variables

Variable	*Mean*	*SD*	*1*	*2*	*3*	*4*	*5*
1. PERFO.[a]	11.4	24.9	–				
2. AGE	21.4	16.0	-.241**	–			
3. EMPLOYEES	351	1215	-.103**	.215**	–		
4. SALES ($M)	107	523	-.082**	.043	.161**	–	
5. EXPORTS ($M)	17	93	.011*	.109**	.259**	.024	–
6. SECTOR[b]	–	–	.053*	-.129**	-.059*	-.015	-.169**
7. LOCATION[b]	–	–	.113**	-.002	-.016	.119*	.124**

* = Significant at $p < .05$ level ** = Significant at $p < .001$ level.
a All correlations are Pearson coefficients unless indicated otherwise.
b Spearman rank order correlation coefficients

Table 4.8 presents the series of structural models that comprise the analytical framework. Column 1 in the table shows the determinants of the decision to invest abroad (Model 1). At the outset, the large reduction in the number of observation (by two-thirds) should be noted. The model is thus run on a self-selecting sample with all the implications that this implies. As can be seen, this model correctly predicts over 70 percent of the cases. In interpreting the model's coefficients the important feature is their direction and significance. Foreign investment is likely to occur in younger and smaller companies that are oriented to high tech and advanced business services and that service export markets (although the latter is not significant). The probability changes (elasticities at the mean) suggest that a unit change in age and size reduces the average probability of foreign investment by 25 and 61 percent respectively. Similarly, an increase in export or high tech orientation is likely to increase the average probability of foreign presence by 6 and 12 percent.

At the next stage of the analysis (Model 2), the volume of foreign investment is predicted as a function of the firms' attributes plus the probability to invest abroad. In this instance, it is obvious that the prior strategic decision to invest abroad will have a large effect on the actual volume of that investment. However our interest here is in seeing the marginal effect of the other firm attributes after that strategic decision has been made. Does firm size age or market orientation impact on the magnitude of foreign investment once, the decision has been taken, and if so, to what extent? Because of the path-like structure of the model we can assume that

decisions regarding the size of foreign investment already subsume the more basic decision to invest abroad and that factors such as firms age and size will have some independent influence. The standardized coefficients of the model (β's) are directly interpretable and are taken as representing the indirect effects on the decision to choose a metropolitan location, affected through the prior decisions to invest abroad.

Table 4.8 Estimating the determinants of foreign investment and locational choice

	Model 1		*Model 2*		*Model 3*	
	Logit	ΔP^2	b^3	β	*Logit*	ΔP
Constant	.271	–	-2.350	–	-.475	–
	(.451)[4]		(3.326)		(.685)	
AGE	-.017*	-.257	-.00022	-.015	-.013*	-.131
	(.006)		(.043)		(.004)	
LOGEMP.	-.449**	-.619	-1.031	-.028	-.150**	-.326
	(.144)		(1.065)		(.162)	
LOGEXP.	.019	.061	1.153	.040	.234**	.673
	(.114)		(.823)		(.118)	
HIGH TECH[1] (OTHER)	.636**	.126	3.336*	.038	.869*	.136
	(.205)		(2.453)		(.394)	
FOROWN[1] (NO FOROWN)	–	–	36.64**	.750	–	–
			(1.64)			
PERFO	–	–	–	–	.005	.040
					(.003)	
Means, Dep. Var.	.27		11.4		.58	
n	691		688		686	
R^2	–		.55		–	
-2x log likelihood	797.9		–		904.9	
χ^2 values for model / d.f.	38.8 / 5		–		25.1 / 5	
Percent correctly predicted	70.9		–		58.9	

* Significant at p < .05 level.
** Significant at p < .001 level.
1. Dummy Variables, reference group in parenthesis.
2. Change in probability, estimated at the mean from a unit change in the independent variable.
3. b = untransformed coefficients; β = standardized coefficients for continuous variables.
4. Standard Errors in parenthesis.

The results presented here validate the suggestion regarding the marginal impacts of firm attributes. These are all of the order of 1-4 (β values range from (-.02) to (+ 0.03) percent change in the mean level of foreign ownership with a unit change in firm characteristics (employees, sales etc). Overall the major effect is of course, the basic decision to invest abroad. A categorical change in this variable will account for some 75 percent of the probability of change in the level of foreign investment).

While Models 1 and 2 have estimated the indirect effect on metropolitan locational choice, Model 3 presents the direct coefficients through a further logit regression. This model correctly predicts just under 60 percent of all cases. The average likelihood of metropolitan location is 58 percent and it is against this yardstick that all changes need to be measured. The direction and significance of the logits and the size of the various Δ*P*'s indicate that of all the direct effects, high tech and export specialization, increase the likelihood of a metropolitan location, at the mean by 13 and 67 percent respectively. Likewise, the size and age of the firm decrease this probability, by 32 and 13 percent. All these determinants are statistically significant.

Interestingly, the volume of foreign ownership while displaying the right sign, is not found to be a major determinant. Its' direct impact of the average probability is very small (a change in 1 percent foreign ownership increases the average probability of metropolitan location by 4 percent). This does not mean that the decision process outlined above cannot be upheld. Rather, it points to the fact the direct effect of foreign ownership on metropolitan location is of a smaller magnitude than the indirect effect.

The probability changes at the mean (Δ*P*'s) indicate that increasing firm size by one year is likely to decrease the mean probability of metropolitan location by some 13 percent. Similarly, increasing firm size by 10 employees, is likely to decrease this probability by 3.2 percent. A categorical move from low to high tech, directly increases the likelihood of metropolitan location by 13 percent. The results also indicate that increasing exports by $1m means a rise of over 60 percent in the average likelihood that the firm will be located in the Tel Aviv metropolitan region.

Combining direct and indirect effects (Table 4.9) leads to the conclusion that in all cases bar one, direct effects are of far larger magnitude than indirect effects. The indirect effects on the probability of choosing the metropolitan area are in most cases rather small. The one exception is, significantly, the effect of foreign ownership. In this case, the sum of the indirect effect outweighs the direct effect. The impact of foreign ownership directly is less than the case when foreign ownership subsumes firm attributes. This difference is in the order of 71 percent (75 percent minus 4 percent). In all other cases, indirect effects do not sum to a figure beyond 20 percent.

Table 4.9 The direct and indirect effects on the probability of choosing a metropolitan location

Variables	*Direct*[1]	*Indirect*
AGE[2]	-.131	.0056
LOGEMP.	-.326	.078
LOGEXP	.673	.199
HIGH TECH	.136	.012
FOROWN	–	.751
PERFO.	.040	–

1. ΔP values.
2. Probabilities for Continuous Variables based on standardized coefficients (β).

4.7 CONCLUSIONS

On the basis of the results presented above three salient points seem to emerge that shed light on the FDI process and the role of the high tech node. The first relates to the tendency of foreign investment to seek out the smaller, newer, more high tech and export oriented firms. This is not the 'classic' pattern of FDI behavior. It suggests very different motives to those that are standard in the literature. It would thus seem that foreign investment in a node economy takes place for reasons other than the incentive of local factors prices. The implications arising from these findings could suggest that local research capacity and the local innovations levels may be the key to understanding 'reverse' patterns of FDI and technology transfer (Mansfield and Romeo, 1984). This occurs when the foreign presence in an overseas location is initiated through investment in R&D and then reverses to production. This is the opposite direction to the classic FDI path which starts with production and local factor advantages and sometimes 'scales-up' to R&D. It should be noted however that this hypothesis has not been directly tested here.

The second finding is that the link between foreign investment and metropolitan location is indirect rather than direct. As seen above, firm attributes have a much larger effect on the probability of locating a metropolitan area, than does the amount of foreign investment in a company. This suggests that once firms have made the strategic decision to invest in an R&D node like Israel, the metropolitan location can serve to endogenize and augment that decision. This can best be accomplished in a metropolitan setting for the obvious advantages of scale economies and increasing returns that can be attained.

Finally, our findings show that all firm attributes display larger direct, than indirect effects in determining the choice of location. Again, this suggests the overwhelming importance of the Tel Aviv metropolitan economy in all that is to do with more advanced production and business services. In this respect, FDI in a research-oriented node economy is akin to 'classic' off-shore investment in developing countries where most economic activity is located in one 'primate' city or strictly follows the local urban hierarchy (Cantwell and Iammarino, 2000). It

could be that in a small country like Israel, foreign investment is 'indifferent' to many locations, only because so many of them fall within the orbit of the Tel Aviv metropolitan (and to a lesser extent, the Haifa metropolitan) area.

NOTES

[1] Following Petersen (1985), ΔP is calculated as follows:

$$\Delta P = exp(L1)/[1+exp[(L1)] - exp\ (L0)/[1+exp(L0)]$$

where:
L0 = the logit before the unit change in the dependent variable *xy*
L1= the logit after the unit change in the independent *xy* (ie $L0+\beta_j$)

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