Internationalization Strategies and Productivity: Evidence from Foreign Owned Companies Operating in the Greek Manufacturing Sector

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Abstract
This paper using Malmquist productivity indexes analyzes the impact of internalization on productivity efficiency and competitive advantage for a sample of 395 firms with foreign ownership operating in the Greek manufacturing sector. A number of different factors in respect to firms' productivity performance and creation of competitive advantage are been explored. The productive and most competitive firms with foreign ownership seem to have definite and strong characteristics relative to their size. Our empirical results imply that the resources (tangible and intangible) which are utilized and obtained through the firms internationalization strategies have a direct impact on the firms' productivity and hence to their competitive advantage.

Keywords: Foreign Owned Firms; Internationalisation; Malmquist Productivity Index; Productivity Efficiency.

JEL Classification Codes: F23, L25, L60, O30

Introduction

Nowadays, it is clear that the exploitation of power by "big" business is no longer limited within national boundaries. This power is significantly increased when exercised by a multinational company (MNE) operating globally. Possible economies of scale as well as the greater spread of risks may be considered as advantages of MNEs from the point of view of shareholders.

But the industrial organization approach suggests that multinationals face some disadvantages when competing with local firms such as market imperfections (in the goods and factor markets): special marketing skill, local firms' advantages in raising capital, superiority of management or special patents and general superiority in technology. Moreover, other disadvantages are associated with internal and external economies of scale and governments' interference with production or trade. In order to overcome these disadvantages, multinationals must possess some kind of ownership advantages in order to compete with local enterprises. Such advantages may include superior technology, management or marketing skills, cost effectiveness, established market and financial strength. Having these advantages they create a competitive posture over the local firms and increase their market power (Hymer 1960, 1968, 1976; Kindleberger 1969; Harris and Robinson 2003; Barbosa and Louri 2005).

The process regarding the decision to invest in a foreign country is based upon different external and internal factors but most of the time is based upon the control of some firm-specific proprietary asset rather than transacting it via the market. So, the higher the forces of market imperfections, the greater will be the need for control of assets through foreign direct investment (hereafter FDI) (Hymer 1960, 1976). FDI strategies are not concentrated only through the transfer of capital, because, this could be supplied to local firms using other forms of international financing. These strategies may also include proprietary and intangible assets, including technology, business techniques, skilled personnel and market channels. Therefore, host economies can benefit from such inflows (Caves 1996; Fan and Dickie 2000; Hymer 1976).

In addition the transaction-cost/internalization theory provides an economic rationale for the existence of multinationals. It is mainly based on the works by Coase (1937) and Hymer (1960). In addition to production of commodities, businesses carry out several other activities such as marketing, R&D, training of labor, which are related through flows of intermediate products, mostly knowledge and expertise. Consequently, firms create internal markets to bypass imperfections of intermediate product markets. If they can organise their transactions more efficiently than markets then firms expand abroad. If the costs of adaptation, performance monitoring, know-how, raw materials and components, marketing and distribution services and safeguarding against opportunistic behaviour are too high, the firms will prefer internal governance structures.

Most of the times firms choose the least “costly” location for their activities. Therefore, they internalise the markets up to the point where the benefits for further internalisation are outweighed by the costs. The costs of internalisation will be lower, if the foreign market is similar to the home market. Finally, foreign markets are internalised, multinational’s internal transfers of goods and services become exports and imports for the countries between which they are transferred (Buckley 1988, 1996; Buckley and Casson 1976; Buckley and Pearce 1979; Caves 1982; Hennart 2001; Luo 2001; Rugman 1981).

This theory has been used to analyze foreign market entry strategies. A high-control entry mode may be chosen if foreign markets are very attractive, if the multinational's home country is culturally very distant from the host country or if the need for local contributions such as capital, technology and skilled labour is low. An increase in net additional costs (higher tariffs, transport costs or loss of economies of scale in domestic production) forces the firm to move production abroad. An increase in the cost of building trust discourages acquisition and favours either greenfield investment or "arm's length" arrangements. A high cost of learning about the foreign market through experience encourages acquisition, licensing and franchising and discourages subcontracting or greenfield investment in distribution. A high transaction cost for intermediate output encourages the vertical integration of production and distribution. A high transaction cost for arm's length technology transfer favors FDI over arm's length arrangements, like subcontracting. However, subcontracting is not a very attractive mode of foreign market entry and it is mainly used for getting access to local resources (Anderson et al. 1986; Bello and Lohtia 1995; Buckley and Casson 1998; Hill et al. 1990; Luo 2001; Madhok 1997).

Bernard et al (2000) suggested that international activities constitute a higher "efficiency huddle" than domestic sales. Porter (1987) stressed that resource sharing and transfer of skills are the most important concepts in corporate strategy because they allow the business units to increase their productivity and build a competitive advantage in their respective industries. In this paper using essential variables such as the number of employees, the foreign ownership, the profit margin, sales, intangible and tangible assets, working capital and the liquidity ratio we evaluate their influence on firms' productivity and competitive advantage.

Moreover, the main research question of the paper is concentrating on: *"how different factors are affecting firms' productivity and competitive advantage according to their size"*. Specifically with a sample of 395 firms with foreign ownership operating in the Greek manufacturing sector, we analyse according to firms' size the effect of the variables under consideration. Using the Malmquist productivity index and its decomposition to technological and efficiency change we determine the key factors, influencing firms' total productivity, technological and efficiency change.

The paper is structured as follows. In the next section the main factors from internationalisation theory are analysed in respect to firms' productivity efficiency and competitive advantage. Next, the measurement of productivity and technological efficiency, the data used and the proposed methodology for the construction of productivity indexes are analysed. The next section is focused on the empirical results derived while the last sections concludes the paper and discusses the implications of the key characteristics determining productivity efficiency and competitive advantage of the sample of foreign owned firms operating in the Greek manufacturing sector.

1. Literature Review

There is a substantial literature regarding firm internalisation, productivity efficiency and competitive advantage. Barlett and Ghoshal, (1987a, b) have proposed that the human resources of the firm are a significant source of competitive advantage. Seth (1990) has proposed that an increased output will allow spreading the fixed costs over a larger amount, thereby reducing the average total cost. In the event that the production factor can be used to produce other varieties, joint utilisation of that factor would result in scope economies. Of course, economies of scope are not only restricted to production factors. The joint use of a distribution channel or a sales organisation and the common use of an R&D department may all lead to scope economies.

However, Teece (1980) has pointed out that economies of scope have no direct implications for the scope of the firm, i.e. economies of scope in itself form no direct rationale for diversification. By extending Williamson's (1975) analysis of transaction costs for vertical integration, Teece has rightly pointed out that it is the facility with which the common input or its services can be traded across markets that will determine whether economies of scope will require the enterprise to be multiproduct in its scope (1980: 226).

According to Hill (1994) the transaction cost literature provides two reasons why internalization might be preferred. The *measurement branch* focuses on measurement problems in transactions and argues that these measurement difficulties create opportunism and a free riding problem. In order to overcome these problems costly monitoring and contracting schemes must be developed so that the net value of the cooperation decreases significantly. Teece (1980) described this process for two 'inputs': know-how and indivisible physical assets. However, other resources can be the source of economies of scope.

A common classification of resources is described by Hoskisson and Hitt (1990) and Chatterjee and Wernerfelt (1991). Distinction is made between several types of resources:

- *physical or tangible resources,* which usually include plant and equipment, sales forces and distribution channels. They are less flexible than the other resources;
- *intangible resources* which include brand names or innovative capabilities and know-how. These resources were identified by Rumelt (1982) as core factors;
- *financial resources*, which are more mobile and less rare and thus likely to create less value than the other resources (Hoskisson and Hitt, 1990).

The distinction between tangible and intangible resources corresponds to two main concepts of corporate strategy developed by Porter (1987) and further elaborated by Haspeslagh and Jemison (1991): *resource sharing* and *transfer of skills*. Resource sharing is based on sharing activities in the value chains among businesses (e.g. two business units sharing the same R&D department). Transferring skills involves the transfer of knowledge from one value chain to the other. For instance, the marketing know-how built in the beer industry may be transferred to the cigarettes business because of the similarities in types of buyers (Porter, 1985). Haspeslagh and Jemison identify two kinds of skill transfer:

(1) functional skill transfer, which is concerned with the bringing in of functional skills of one company to the other, and (2) general management skill transfer, which occurs when one firm

can make another more competitive by improving the range or depth of its general management skills. Porter (1987) stressed that resource sharing and transfer of skills are the most important concepts in corporate strategy because they allow business units to increase their productivity and build a competitive advantage in their respective industries.

On the other hand, the eclectic (OLI) paradigm offers an analytical framework for incorporating a number of approaches, including the industrial organization and internalization/transaction-cost approaches, the product life-cycle model and the resource-based view, each of which seeks to explain a particular component of the internationalization process. The paradigm tries to explain why multinationals exist and why they are relatively more successful than domestic firms (Dunning 1988b, 2001; Dunning and Wymbs 2001). It shows that the extent and pattern of international production will be determined by the configuration of three sets of advantages (Dunning 1979, 1980, 1988ab, 1995, 2001; Dunning and Bansal 1997)[1].

The ownership (O-) advantages — the (net) competitive advantages which firms of one nationality possess over those of another nationality in supplying any particular market or set of markets. These advantages are either derived from the privileged possession of specific intangible assets, for example, superior technology, efficient production processes and marketing systems; or from the common governance of a set of interrelated activities at home or abroad. The O-advantages of multinationals depend not only upon those internally generated, but also upon their competence to seek out, harness and influence innovation, price and quality of assets of other institutions with which they have an on going cooperative relationship.

The locational (L-) advantages is the extent to which firms choose to locate the value-adding activities outside their national boundaries. In its choice of a foreign site for its activities, an MNE is influenced not only by how location-bound resources and/or markets affect its direct costs, but also by how they affect its ability to acquire and exploit the O-specific assets of firms with which it has some kind of coalition.

Finally, *the internalization (I-) advantages* is the extent to which firms perceive it to be useful to internalize the markets for the generation and/or the use of their O-specific assets. The more a country's enterprises possess O-advantages relative to enterprises of other nationalities, the greater the incentive they have to internalize their use. The more they find in their interest to exploit them from a foreign location, the more they are likely to engage in international production.

The eclectic paradigm further avers that the significance of each of these advantages and the configuration between them is likely to be context specific. In particular, it is likely to vary across industries or types of value-added activities, regions or countries and among firms (Dunning 2001). In a modified version of the OLI framework, the source of a firm's advantage lies at the level of headquarters or subsidiary or the systemic relations between them. Management of a firm's global stocks and flows of knowledge has become a critical issue and perhaps the ultimate source of the O-advantage. Besides enabling the MNE to exploit some home country-based advantage, the host country should provide complementary assets to enhance such advantage and build system-wide assets, which enable the firm to become more competitive. In addition, FDI and other entry forms are not substitutes but complements (Madhok and Phene 2001). According to the OLI framework, firms mainly invest for four reasons: market-, efficiency-, resource- and strategic asset seeking (Dunning 1994, 1998, 2001; Narula 2001).

- *Resource- seeking* FDI are mainly influenced by availability, price and quality of natural resources. These investments provide the host country with some technology, organizational and management competence and give access to foreign markets. On the other hand, they are footloose and have a low value-added.

- *Market- seeking* investments are made to serve the domestic market, but occasionally also some adjacent regional markets. Real wage, material and transport costs are important for FDI of this type, but skilled and professional labor, high-quality national and local infrastructure and local service support facilities are also necessary. In addition to fostering backward supply linkages, these investments may provide complementary assets, raise product quality and stimulate local entrepreneurship.
- *Efficiency- seeking* FDI are mainly made for production cost related reasons, but science and industrial parks, service support systems, trained labor force, an entrepreneurial environment and cooperation between firms are also important. These investments foster backward supply linkages, improve cross-border networking, provide access to foreign markets and sources of supply.
- *Strategic asset- seeking* FDI are mainly made to protect or augment the investing firm's core competences. They depend on the availability of knowledge-related assets and markets necessary to protect or enhance the O-advantages of investing firms, but also on exchange of knowledge, ideas and interactive learning. These investments provide new finance capital and complementary assets, access to foreign markets, stimulate local entrepreneurship and improve cross-border networking.

Finally, at a primary stage FDIs are mainly made for natural resources and market seeking while efficiency seeking and strategic asset seeking are mainly reasons for making sequential FDI (Dunning 1988a, 1994). The main factors drawn from the literature of internationalization which affect firms' productivity and competitive advantage are analyzed below in a framework of inputs and outputs and in the Data Envelopment Analysis (DEA) framework.

2. Measurement of productivity and technological efficiency

Productivity calculated here is the total factor productivity (TFP) and indicates total output per total input. That is, productivity in relation to the overall input. However, there is a problem with, the method of tabulating multiple inputs and outputs and gauging productivity. Here, assuming a production function with two outputs and six inputs (as described below), the proportion that cannot be explained by growth in the six inputs was calculated as the TFP. In terms of the efficient use of technology, it is possible to comprehend the rise in productivity, that is, the technological progress, as the degree of efficiency with which companies use their production factors.

Technological progress can be summarized by the following two types. The first is the technology efficiency consisting of whether or not a given level of technology is been used efficiently. The other is the change in the level of technology itself. Even if a certain level of advanced technology or practice exists, when no firm is able to use it with full efficiency, there will be no improvement in technological progress overall and not a gain of competitive advantage. The extent of the technological progress of the foreign owned firms as a whole is thought to be a combination of both efficiency and change in the technological level.

Can TFP thus be considered an appropriate index of technological progress and competitive advantage of firms? In order to clarify the efficiency of technology, it is necessary to establish an appropriate classification and tabulation of inputs as well as outputs. Various problems have been pointed out proving this, and the so-called productivity paradox occurs in which the calculated TFP moves in a different direction than it was expected.

Therefore, in this study we intend to prove how efficiently firms within the Greek manufacturing sector use production factors or if disparities in efficiency arise between firms by measuring the productivity at the level of each firm and using that to estimate the technological frontier (isoquant curve). More specifically, the disparities in productivity between firms with foreign ownership within the Greek manufacturing sector are clarified by calculating the Malmquist productivity index using data envelopment analysis procedures in estimating the technological frontier. The next section explains how productivity is comprehended by this approach.

2.1 The methodology

Technological efficiency indicates the degree of deviation from the most efficient technological frontier at a given point in time and therefore it is static in nature. However, in time-series and in order to comprehend technological progress changes dynamically, we have to consider the changes in the technological frontier.

In figure 1 we form a hypothetical isoquant curve with one output O and two inputs (production factors), I_1 and I_2. The continuous bold line represents the technological frontier of period t while the technological frontier of period t+1 is represented by the dotted line. The shift width from the continuous line to the dotted line is a time series change in the technological frontier. If the technological frontier shifts, the technological efficiency of the firms that deviate from that line also changes. The width of the deviation of the technological frontier at period t was B. However, it shifted to deviation width C due to the shift in the technological frontier. Since deviation widths B and C are represented in actual measurements by the distance from the origin, the difference in the relative ratio expresses time series change. Changes in total technological progress (TFP), include the two elements of the above changes in the technological frontier (TEC) itself and changes in the technological efficiency (EFF) of firms deviating from there. The Malmquist productivity index indicates changes in productivity by combining these two.

Figure 2 explains diagrammatically the principles introduced by Fare et al. (1994) for constructing and decomposing Malmquist productivity indexes (MPI). The technological frontier is expressed as TF and a given firm located in a position deviating from that is expressed as F. The technological efficiency of F_t during period t is expressed as the ratio of $0F_t$ and 0B. If F_t shifts to F_{t+1} during period t+1, the changes in technological efficiency can be expressed as:

$$\frac{0C/0F_t}{0D/0F_{t+1}} \quad (1)$$

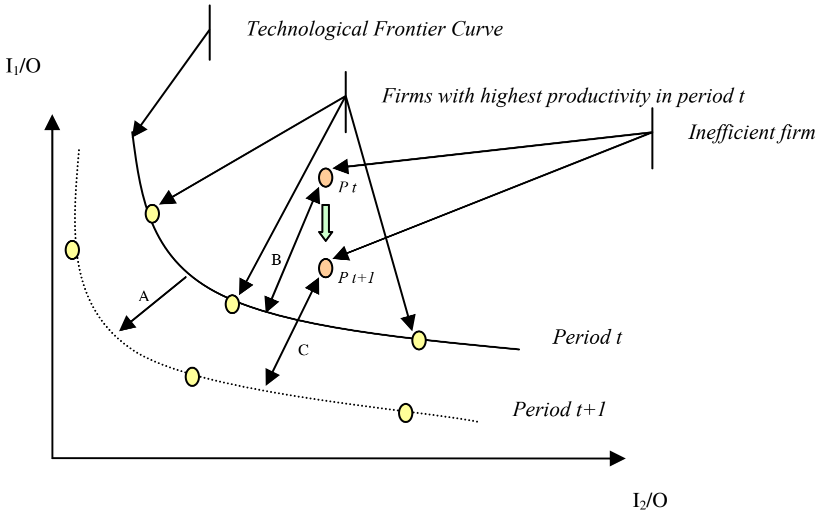


Figure 1: The concept behind the Malmquist Productivity Index (MPI or TFP)

The technological efficiency of F in relation to technological frontier TF_t rises if this is less than 1. However, since the technological frontier also shifts to TF_{t+1} during period t+1, it is necessary to take into account the changes in technological efficiency of F in relation to technological frontier TF_{t+1}, that is:

$$\frac{0C/0F_t}{0E/0F_{t+1}} \quad (2)$$

If this is also less than 1, it indicates that there has been an improvement in technological efficiency. The Malquist productivity index (TFP) determines the geometrical average of (1) and (2):

$$TFP = \sqrt{\frac{0C/0F_t}{0E/0F_{t+1}} x \frac{0C/0F_t}{0D/0F_{t+1}}} \quad (3)$$

Equation (3) can be decomposed as

$$TFP = \left(\frac{0B/0F_t}{0E/0F_{t+1}}\right) X \sqrt{\left(\frac{0E/0F_{t+1}}{0D/0F_{t+1}} x \frac{0C/0F_t}{0B/0F_{t+1}}\right)} = \text{EFF x TEC} \quad (4)$$

Thus the Malmquist productivity index (TFP) can be decomposed to the product of EFF, which expresses changes in technological efficiency and TEC that represents changes in the technological frontier. IF EFF is more than 1, then this indicates that it has approached the technological frontier and if it is less than one, it indicates that it lags behind the technological frontier. If TEC is more than one, the level of technological frontier itself is rising and, if it is less than 1, it is declining. Using the TFP index, allows us to divide technological progress. Our purpose is to define how the variables under consideration influence such changes and how they determine firms' productivity and competitive advantage according to firms' size. The inputs and outputs used in our study are presented next.

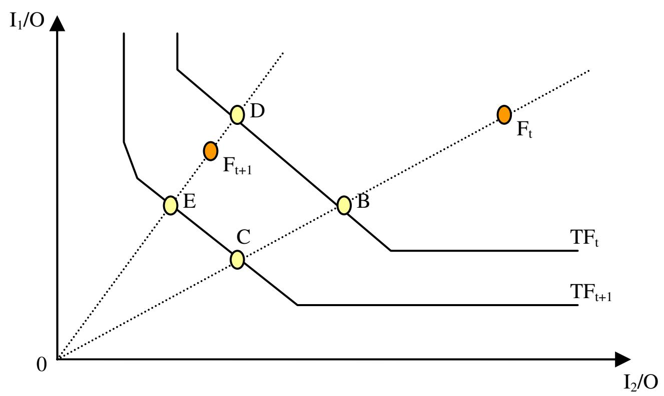


Figure 2: Total factor productivity, technological change and technological efficiency

2.2 The data

In order to analyze the impact of internalization on productivity efficiency and competitive advantage amongst the foreign owned firms we analyze 395 firms with foreign ownership operating in the Greek manufacturing sector. The dataset is provided by ICAP directory[2] and covers the time period from 1995 to 2001. In order to extract the Malmquist productivity indexes we need to clarify the sets of inputs and outputs to be considered. The inputs used are:

- Liquidity ratio (LR) = Current assets/Current liabilities (creditors due within one year).

- Working capital (WC) = Current assets-Current liabilities
- Number of employees (NE)[3]
- Intangible fixed assets (000s $) (INF) (see above for clarification of this variable)
- Tangible fixed assets (000s $) (TFA) (see above for clarification of this variable)
- Percentage of total foreign ownership (UOP)

and the two outputs are:

- Sales (000s $) (SA)
- Profit margin (PM) = (profit before interest and taxation/sales) x 100

The DEA (Data Envelopment Analysis) model for constructing the Malmquist productivity index is presented next.

2.3 Extracting the Malmquist productivity indexes

Malmquist productivity indexes were introduced by Caves et al. (1982), who first developed these measures for variable return to scale (VRS) technologies, assuming overall efficiency and a translog technology for output distance functions. Though the authors could not provide direct estimates of the Malmquist index (MI), they noticed that the geometric mean of two MI was equilevant to a scaled Tornqvist-Theil productivity index.

Subsequently, Fare et al. (1994) developed a non-parametric approach for estimating Malmquist indexes, and showed that the component distance function could be derived using a DEA-like linear program method. Furthermore, they showed that the resulting total factor productivity indexes (TFP) could be decomposed into efficiency change (EFF) and technical change (TEC) components. This method shows two main advantages. First, no assumption on the functional form of the underlying production technology was required. And second, unlike the Tornqvist TPF indexes, for the Malmquist indexes, data on output and input prices are not indispensable, hence making the method particularly suited for "cases" where price data are not readily available.

The Malmquist TFP index is defined using distance functions, which allow us to describe a multi-input multi-output production technology without having to specify a behavioral objective such as cost minimization or profit maximization (Rao and Coelli, 1998). An input distance function characterizes the production technology by looking at a minimal proportional contraction of the input vector, given an output vector. An output distance function considers a maximal proportional expansion of the output vector, given an input vector.

The output distance function is defined on the output set *P*(x), as:

$$d_0(x,y) = \min\{\theta : (y/\theta) \in P(x)\} \tag{5}$$

where the output set *P*(x) represents the set of all output vectors, *y*, which can be produced using the input vector *x*.

Even though the method is easily accommodated to the multi-output multi-input case, for clarity purposes the exposition is limited to the single output, single input and output-oriented case. Following Fare et al. (1994) Malmquist index (MI) – TFP change between a base period (*s*) and a period *t* can be written as:

$$m_0(y_s, x_s, y_t, x_t) = \frac{d_0^s(y_t, x_t)}{d_0^s(y_s, x_s)} \left[\frac{d_0^s(y_t, x_t)}{d_0^t(y_t, x_t)} \frac{d_0^s(y_s, x_s)}{d_0^t(y_s, x_s)} \right]^{1/2} \tag{6}$$

where the notation $d_0^s(y_t, x_t)$ represents the distance from the period *t* observation to the period *s* technology. A value of *m* greater than one will indicate positive TFP growth from period *s* to period *t*.

In expression (6), the term outside the square brackets measures the Farell efficiency change (EFF) between periods *s* and *t* , and the term inside measures technical change (TEC), which is the geometric mean of the shift in the technology between the two periods. Thus, the two terms in equation (6) are:

$$EFF = \frac{d_0^s(y_t, x_t)}{d_0^s(y_s, x_s)} \tag{6.1}$$

$$TEC = \left[\frac{d_0^s(y_t, x_t)}{d_0^t(y_t, x_t)} \frac{d_0^s(y_s, x_s)}{d_0^t(y_s, x_s)} \right]^{1/2} \tag{6.2}$$

The efficiency change component is equivelant to the ratio of the Farell technical efficiency in period *t* to the Farell technical efficiency in period *s*, under constant returns to scale (EFF_{CRS}). This efficiency change component can be separated into scale efficiency and pure technical efficiency change. The latter is obtained by re-computing efficiency change under variable returns to scale (EFF_{VRS}). The former is therefore the ratio of efficiency under constant and variable return to scale (EFF_{CRS}/EFF_{VRS}).

The overall index in (6) represents the productivity of the production point (y_t,x_t) relative to point (y_s,x_s). A value greater than one depicts positive TFP growth between periods *s* and *t*. Empirical applications require the computations of the four distance functions in (6). As suggested by Coelli (1996), the distance functions can be estimated by solving the following DEA-like linear programs:

$$\begin{aligned}
&\left[d_0^t(x_t, y_t)\right]^{-1} = \max_{\phi,\lambda} \phi, \\
&s.t. -\phi y_{it} + Y_t\lambda \geq 0 \\
&x_{it} - X_t\lambda \geq 0' \\
&\lambda \geq 0,
\end{aligned}$$

$$\begin{aligned}
&\left[d_0^{t+1}(x_{t+1}, y_{t+1})\right]^{-1} = \max_{\phi,\lambda} \phi, \\
&s.t. -\phi y_{i,t+1} + Y_{t+1}\lambda \geq 0 \\
&x_{i,t+1} - X_{t+1}\lambda \geq 0' \\
&\lambda \geq 0,
\end{aligned}$$

$$\begin{aligned}
&\left[d_0^{t+1}(x_{t+1}, y_{t+1})\right]^{-1} = \max_{\phi,\lambda} \phi, \\
&s.t. -\phi y_{i,t+1} + Y_t\lambda \geq 0 \\
&x_{i,t+1} - X_t\lambda \geq 0' \\
&\lambda \geq 0,
\end{aligned}$$

$$\begin{aligned}
&\left[d_0^{t+1}(x_t, y_t)\right]^{-1} = \max_{\phi,\lambda} \phi, \\
&s.t. -\phi y_{it} + Y_{t+1}\lambda \geq 0 \\
&x_{it} - X_{t+1}\lambda \geq 0' \\
&\lambda \geq 0,
\end{aligned} \tag{7}$$

Table 1a: Average Total factor productivity (TFP),
Average Technological Change (TEC)
and Average Efficiency Change (EFF),
of Big size firms.

a/a	Dmus	TFP	TEC	EFF	a/a	Dmus	TFP	TEC	EFF
1	1 .	1,00	0,00	1,00	23	24 .	1,04	-0,01	1,05
2	2 .	1,05	-0,02	1,07	24	86 .	1,28	0,42	0,86
3	3 .	1,05	0,01	1,04	25	46 .	0,88	0,12	0,76
4	77 .	0,92	0,00	0,92	26	27 .	1,08	0,14	0,94
5	31 .	0,97	0,02	0,95	27	80 .	1,07	0,24	0,84
6	42 .	0,96	0,04	0,92	28	29 .	1,10	0,16	0,93
7	30 .	1,08	0,07	1,01	29	136 .	1,07	0,23	0,84
8	97 .	1,12	0,10	1,03	30	23 .	1,09	0,13	0,95
9	9 .	1,12	0,05	1,07	31	91 .	0,90	0,08	0,81
10	121 .	1,29	-0,51	1,80	32	5 .	1,70	0,02	1,68
11	17 .	1,05	0,04	1,01	33	41 .	1,07	0,21	0,86
12	82 .	1,10	0,34	0,76	34	33 .	0,88	0,01	0,86
13	7 .	0,94	0,00	0,95	35	141 .	1,15	0,26	0,90
14	12 .	2,10	0,05	2,05	36	127 .	1,12	0,23	0,89
15	90 .	1,33	0,17	1,16	37	32 .	0,99	0,02	0,96
16	6 .	1,34	0,22	1,12	38	16 .	0,99	0,00	0,99
17	35 .	1,21	0,33	0,88	39	19 .	0,97	-0,10	1,07
18	14 .	1,25	0,23	1,01	40	52 .	0,98	0,08	0,89
19	25 .	1,13	0,13	1,00	41	22 .	1,07	0,04	1,03
20	107 .	1,01	0,12	0,89	42	28 .	1,01	-0,02	1,03
21	15 .	1,04	0,04	1,00	Averages		1,14	0,08	1,06
22	109 .	1,00	0,24	0,76					

Table 1b: Average Total factor productivity (TFP),
Average Technological Change (TEC)
and Average Efficiency Change (EFF),
of Medium size firms.

a/a	Dmus	TFP	TEC	EFF	a/a	Dmus	TFP	TEC	EFF
43	49 .	0,97	0,14	0,83	98	18 .	1,29	0,11	1,18
44	59 .	1,02	0,24	0,78	99	37 .	0,90	-0,01	0,91
45	11 .	0,99	0,02	0,96	100	58 .	1,35	0,24	1,11
46	54 .	1,04	0,24	0,80	101	67 .	1,12	-0,37	1,49
47	21 .	1,02	-0,29	1,32	102	69 .	1,09	-0,21	1,30
48	116 .	2,37	0,60	1,77	103	56 .	1,04	-0,30	1,34
49	39 .	1,17	0,24	0,93	104	140 .	1,26	-0,26	1,52
50	20 .	1,14	0,16	0,98	105	138 .	1,11	-0,03	1,14
51	4 .	0,99	-0,01	1,00	106	235 .	1,76	0,40	1,36
52	44 .	0,94	-0,03	0,96	107	219 .	1,85	0,37	1,48
53	51 .	1,07	0,20	0,88	108	72 .	0,99	0,17	0,82
54	74 .	1,31	0,33	0,99	109	50 .	1,09	-0,08	1,17
55	79 .	1,02	0,14	0,87	110	34 .	1,02	0,07	0,95
56	88 .	1,50	0,44	1,05	111	149 .	0,94	0,15	0,79
57	202 .	0,96	-0,32	1,28	112	146 .	0,97	0,08	0,89
58	66 .	1,02	0,18	0,84	113	57 .	1,05	-0,01	1,06
59	47 .	1,38	0,32	1,06	114	102 .	0,99	-0,11	1,09
60	87 .	1,29	-0,09	1,38	115	68 .	1,04	-0,04	1,08
61	135 .	1,04	-0,02	1,06	116	38 .	1,16	-0,02	1,19
62	126 .	1,38	0,32	1,06	117	55 .	1,18	0,04	1,14
63	179 .	1,64	0,51	1,13	118	190 .	1,32	0,49	0,83
64	92 .	0,99	0,06	0,94	119	132 .	1,05	-0,02	1,07
65	106 .	1,22	0,35	0,88	120	388 .	1,08	0,03	1,05
66	53 .	1,11	-0,32	1,43	121	94 .	1,04	0,04	1,00
67	178 .	1,47	0,17	1,30	122	240 .	1,71	0,59	1,11
68	8 .	1,19	0,21	0,98	123	198 .	1,20	-0,07	1,27
69	133 .	1,30	0,30	1,00	124	298 .	0,86	-0,19	1,05
70	103 .	1,14	0,29	0,85	125	145 .	1,11	-0,31	1,43
71	195 .	1,09	0,18	0,91	126	148 .	1,08	-0,02	1,10
72	36 .	1,01	0,01	1,00	127	100 .	1,17	-0,13	1,30
73	117 .	0,95	0,03	0,92	128	43 .	1,09	0,08	1,02
74	48 .	2,02	0,76	1,25	129	62 .	1,48	0,00	1,48
75	172 .	0,93	0,12	0,82	130	150 .	1,10	-0,42	1,52
76	169 .	1,00	-0,07	1,07	131	76 .	1,01	0,13	0,88
77	40 .	1,14	-0,38	1,52	132	81 .	0,92	-0,14	1,05
78	212 .	0,83	-0,07	0,90	133	64 .	1,16	-0,03	1,19
79	113 .	1,27	0,42	0,84	134	170 .	1,06	0,13	0,93
80	197 .	1,08	0,09	0,99	135	144 .	1,07	0,11	0,96
81	45 .	1,31	-0,07	1,38	136	228 .	1,47	0,29	1,18
82	71 .	1,03	0,19	0,84	137	84 .	0,94	-0,06	1,00
83	65 .	1,23	0,20	1,03	138	134 .	1,16	-0,41	1,57
84	181 .	1,96	0,22	1,74	139	221 .	1,26	0,34	0,92
85	70 .	0,93	-0,31	1,24	140	137 .	0,96	-0,17	1,13
86	110 .	1,24	-0,49	1,73	141	153 .	1,07	0,12	0,95
87	105 .	1,21	0,09	1,12	142	176 .	1,04	-0,02	1,06
88	156 .	1,04	0,12	0,92	143	210 .	2,41	0,70	1,71
89	161 .	2,05	0,85	1,19	Averages		1,21	0,075	1,14
90	130 .	1,23	0,12	1,12					
91	99 .	3,43	-0,38	3,81					
92	331 .	1,04	0,16	0,88					
93	83 .	1,38	0,07	1,31					
94	131 .	1,49	0,21	1,28					
95	61 .	1,04	0,06	0,98					
96	111 .	0,97	-0,20	1,17					
97	89 .	0,91	0,00	0,91					

Table 1c: Average Total factor productivity (TFP), Average Technological Change (TEC) and Average Efficiency Change (EFF) of Small size foreign owned firms

a/a	DMU	TFP	TEC	EFF	a/a	DMU	TFP	TEC	EFF	a/a	DMU	TFP	TEC	EFF	a/a	DMU	TFP	TEC	EFF	a/a	DMU	TFP	TEC	EFF
144	155	0,94	-0,05	1,00	199	283 .	2,02	0,31	1,71	254	274 .	1,14	0,25	0,89	309	395 .	1,64	0,36	1,28	364	346 .	1,02	0,15	0,87
145	164	1,06	0,08	0,98	200	73 .	0,97	-0,03	1,00	255	340 .	1,06	0,04	1,03	310	118 .	1,01	-0,19	1,21	365	334 .	1,08	-0,11	1,19
146	201	1,31	-0,16	1,47	201	147 .	1,02	-0,03	1,05	256	266 .	1,12	-0,07	1,19	311	229 .	0,90	0,05	0,84	366	242 .	1,92	0,14	1,78
147	159	0,91	-0,09	0,99	202	139 .	1,52	0,50	1,02	257	222 .	1,03	-0,10	1,13	312	292 .	3,85	2,25	1,59	367	324 .	1,28	0,22	1,06
148	192	1,22	0,16	1,05	203	247 .	1,40	0,31	1,08	258	328 .	0,88	-0,12	1,01	313	320 .	0,79	-0,16	0,95	368	376 .	1,77	0,19	1,58
149	115	1,34	0,19	1,15	204	200 .	0,81	-0,02	0,83	259	165 .	1,33	-0,75	2,07	314	335 .	1,06	0,00	1,05	369	312 .	1,51	0,13	1,38
150	302	1,61	0,54	1,07	205	232 .	1,01	0,00	1,01	260	187 .	1,11	-0,03	1,14	315	347 .	1,58	0,44	1,13	370	323 .	0,96	-0,06	1,01
151	98	1,16	0,01	1,15	206	224 .	0,96	-0,03	0,99	261	254 .	1,81	0,47	1,33	316	367 .	1,37	-0,37	1,73	371	343 .	2,45	0,14	2,30
152	119	0,96	0,01	0,95	207	237 .	1,19	-0,48	1,67	262	157 .	1,33	0,07	1,26	317	377 .	1,55	-0,11	1,67	372	295 .	6,32	3,57	2,76
153	300	1,27	-0,07	1,34	208	278 .	1,41	-0,06	1,48	263	319 .	1,21	0,31	0,90	318	378 .	1,35	0,34	1,01	373	385 .	0,96	-0,23	1,19
154	313	1,12	0,34	0,78	209	174 .	1,26	0,05	1,20	264	341 .	0,93	0,03	0,90	319	394 .	1,06	0,05	1,01	374	227 .	0,87	-0,05	0,92
155	167	1,01	0,04	0,97	210	293 .	1,14	-0,32	1,46	265	361 .	3,50	0,27	3,23	320	371 .	1,99	0,70	1,29	375	369 .	0,88	-0,10	0,97
156	264	1,18	-0,23	1,41	211	357 .	0,95	0,14	0,81	266	263 .	1,07	-0,06	1,13	321	391 .	0,85	-0,03	0,87	376	314 .	1,06	-0,03	1,09
157	380	5,42	0,45	4,97	212	273 .	0,71	-0,03	0,74	267	122 .	1,06	-0,26	1,31	322	257 .	0,86	0,02	0,84	377	364 .	0,80	-0,06	0,86
158	93	1,15	-0,52	1,67	213	215 .	4,79	1,53	3,26	268	216 .	1,04	-0,35	1,39	323	362 .	1,07	-0,65	1,72	378	374 .	1,06	-0,07	1,13
159	75	0,88	-0,38	1,25	214	10 .	1,28	0,15	1,13	269	271 .	0,75	-0,14	0,88	324	286 .	1,88	0,59	1,30	379	349 .	1,73	0,36	1,37
160	175	1,01	-0,25	1,26	215	211 .	1,12	-0,15	1,27	270	281 .	0,80	-0,14	0,94	325	291 .	1,00	0,04	0,96	380	387 .	0,91	0,09	0,82
161	241	1,44	-0,09	1,53	216	308 .	1,34	0,08	1,25	271	382 .	4,18	-2,06	6,24	326	344 .	0,85	-0,27	1,13	381	336 .	1,00	-0,13	1,13
162	205	0,95	-0,11	1,06	217	154 .	1,21	0,24	0,97	272	223 .	2,16	0,42	1,74	327	363 .	1,22	0,21	1,01	382	160 .	1,00	-0,04	1,04
163	220	0,76	-0,56	1,32	218	370 .	1,86	0,41	1,45	273	196 .	1,02	-0,03	1,05	328	256 .	1,12	0,18	0,94	383	322 .	0,88	-0,35	1,23
164	231	1,43	-0,37	1,80	219	183 .	1,34	-0,08	1,42	274	204 .	1,16	0,19	0,97	329	310 .	1,03	-0,39	1,42	384	337 .	0,97	-0,02	1,00
165	125	0,90	-0,15	1,05	220	124 .	1,22	-0,05	1,27	275	246 .	1,15	0,24	0,91	330	381 .	1,17	0,14	1,03	385	386 .	1,07	0,01	1,06
166	280	2,09	0,56	1,52	221	208 .	1,31	0,32	1,00	276	185 .	1,06	-0,18	1,24	331	244 .	0,99	-0,08	1,07	386	393 .	1,34	0,12	1,22
167	129	1,20	-0,03	1,22	222	162 .	0,98	-0,08	1,06	277	339 .	0,91	0,01	0,90	332	373 .	3,01	-14,09	17,09	387	342 .	2,04	0,00	2,05
168	268	1,53	0,20	1,33	223	326 .	1,93	-1,10	3,03	278	193 .	0,94	-0,28	1,22	333	253 .	1,06	0,05	1,01	388	352 .	0,77	-0,08	0,85
169	108	0,97	0,09	0,88	224	184 .	1,42	0,28	1,14	279	236 .	1,16	-0,23	1,39	334	277 .	1,48	-0,30	1,78	389	297 .	5,09	0,50	4,59
170	142	0,98	-0,26	1,24	225	355 .	1,37	0,27	1,10	280	338 .	57,95	16,53	41,42	335	315 .	3,72	-0,52	4,24	390	345 .	1,25	0,00	1,25
171	330	1,18	-0,07	1,25	226	262 .	1,28	0,06	1,23	281	359 .	1,14	0,19	0,96	336	332 .	0,66	-0,19	0,85	391	372 .	3,23	1,28	1,94
172	13	1,10	0,07	1,03	227	163 .	1,19	0,17	1,03	282	177 .	18,61	0,90	17,70	337	375 .	4,19	0,48	3,70	392	384 .	42,66	-0,52	43,17
173	226	1,11	0,09	1,01	228	214 .	1,16	0,11	1,05	283	294 .	0,94	-0,06	1,00	338	230 .	1,10	-0,08	1,18	393	390 .	1,01	0,27	0,74
174	114	0,85	-0,33	1,18	229	191 .	0,98	0,04	0,94	284	186 .	1,38	-0,05	1,44	339	304 .	0,76	-0,21	0,97	394	276 .	1,58	0,01	1,57
175	194	1,05	0,17	0,88	230	63 .	1,25	0,16	1,08	285	189 .	1,01	-0,06	1,07	340	351 .	2,09	0,27	1,82	395	275 .	1,12	-0,14	1,25
176	60	1,26	0,09	1,17	231	171 .	1,10	-0,36	1,46	286	101 .	7,73	3,33	4,40	341	350 .	0,87	-0,05	0,92	**Averages**		2,02	0,09	1,93
177	78	0,95	0,10	0,85	232	269 .	11,59	-1,99	13,58	287	251 .	1,21	0,07	1,14	342	358 .	1,31	0,15	1,17	**Averages**		1,35	-0,002	1,37
178	234	1,21	-0,47	1,68	233	321 .	2,33	0,65	1,67	288	272 .	1,19	0,17	1,02	343	225 .	1,09	0,13	0,96					
179	85	1,14	-0,03	1,17	234	26 .	0,94	-0,06	1,00	289	333 .	1,36	0,45	0,91	344	282 .	0,79	-0,14	0,93					
180	239	1,55	0,47	1,08	235	238 .	1,02	-0,27	1,29	290	290 .	1,06	-0,32	1,38	345	209 .	0,83	-0,09	0,93					
181	104	0,99	-0,33	1,32	236	96 .	1,30	-0,31	1,61	291	354 .	1,52	0,29	1,23	346	284 .	1,15	0,03	1,12					
182	95	0,99	-0,30	1,29	237	245 .	1,33	0,19	1,15	292	267 .	6,09	1,30	4,80	347	285 .	1,25	-0,09	1,33					
183	168	0,82	-0,04	0,86	238	158 .	1,20	0,28	0,92	293	243 .	0,93	-0,17	1,09	348	353 .	2,38	-1,24	3,62					
184	188	1,12	0,20	0,92	239	207 .	0,89	0,03	0,86	294	250 .	1,03	-0,09	1,12	349	120 .	1,34	0,21	1,13					
185	206	1,17	0,34	0,83	240	368 .	1,71	0,34	1,36	295	392 .	1,33	-0,14	1,47	350	218 .	1,04	-0,23	1,27					
186	213	1,11	-0,03	1,14	241	143 .	1,00	-0,01	1,02	296	261 .	1,25	0,10	1,15	351	259 .	1,57	0,43	1,13					
187	166	1,09	-0,26	1,35	242	279 .	0,85	-0,44	1,29	297	249 .	1,16	0,11	1,05	352	309 .	31,38	8,66	22,72					
188	203	0,80	-0,25	1,06	243	311 .	0,98	0,06	0,92	298	199 .	0,98	0,15	0,82	353	360 .	1,62	-0,14	1,76					
189	289	1,26	0,05	1,21	244	217 .	0,91	0,07	0,84	299	327 .	1,93	0,57	1,36	354	383 .	1,06	0,09	0,97					
190	233	1,34	0,49	0,85	245	299 .	2,35	0,35	2,01	300	301 .	2,78	-0,33	3,12	355	389 .	0,83	-0,02	0,85					
191	329	3,10	-0,06	3,16	246	287 .	0,75	-0,25	1,00	301	305 .	1,14	-0,03	1,17	356	348 .	3,42	0,88	2,54					
192	182	1,27	0,13	1,14	247	317 .	2,08	0,92	1,15	302	306 .	1,35	0,28	1,07	357	260 .	1,40	-0,30	1,70					
193	128	1,18	-0,09	1,27	248	270 .	1,10	-0,38	1,48	303	356 .	1,47	0,54	0,93	358	255 .	0,93	-0,01	0,94					
194	173	0,79	-0,05	0,83	249	112 .	1,00	-0,40	1,41	304	366 .	1,14	-0,09	1,23	359	180 .	1,67	0,09	1,59					
195	288	1,51	0,32	1,19	250	152 .	1,09	0,18	0,92	305	307 .	0,92	-0,08	1,00	360	365 .	1,37	0,20	1,17					
196	296	1,36	0,08	1,28	251	265 .	1,10	0,11	0,99	306	318 .	0,99	0,00	0,99	361	123 .	1,27	0,15	1,12					
197	252	0,86	-0,48	1,35	252	303 .	1,20	-0,32	1,52	307	248 .	0,82	0,01	0,81	362	316 .	1,48	-0,56	2,03					
198	151	0,84	-0,29	1,12	253	258 .	1,78	0,47	1,31	308	379 .	0,64	-0,17	0,82	363	325 .	1,04	0,15	0,89					

where λ is a $N\ x\ 1$ vector of constants, φ is a scalar with $1\ x\ \varphi<\infty$ and φ-1 is the proportional increase in outputs that could be achieved by the *i*th unit, with input quantities held constant.

The above programs must be solved for each firm in the sample in each period, and an extra three programs for each firm to construct the chained index. Overall for *N* firms and *T* periods, with the decomposition of the technical efficiency *N* (4*T*-2) LPs are solved (7900 LP in our study).

3. Empirical Results

Following the above methodology we coded each firm with foreign ownership operating in the Greek manufacturing sector from 1995 to 2001 and we produced TFP, TEC and EFF indexes for 1995-96, 1996-97, 1997-98, 1998-99, 1999-00, 2000-01[4]. Moreover, we average the results of the differences of the years under consideration and we formed three sub-tables according to firms' size[5]. Tables 1a, b, c are giving information regarding the firms' (DMUs-Decision Making Units) code and the average value of TFP, TEC, and EFF indexes over the years under consideration. Generally table 1a consists of 42 big–size firms, table 1b includes 101 medium size firms and table 1c 252 small firms[6].

As indicated previously when total factor productivity (TFP) is more than one, this indicates that the firm is productive either from efficiency change (EFF≥1) or from technological change (TEC≥1). For instance, Coca –Cola Hellening Bottling Company S.A. (DMU 1) has a TFP index scoring of 1.00 and that is mainly for its performance of efficiency throughout the seven years with an average score of 1.00 (EFF=1.00). Looking at table 1b and more specifically at the performance of Beiersdorf Hellas A.G. (DMU 54) we notice that it has a score of TFP equal to 1.04 and this is mainly a combination of efficiency (EFF=0.8) and technological (TEC=0.24) change performance. Similarly, looking at table 1c, although IDEAl Group S.A. (DMU 295) has a small size, its TFP score is 6.32, which it is mainly obtained by a high score of efficiency (EFF=2.76) and technological (TEC =3.57) change.

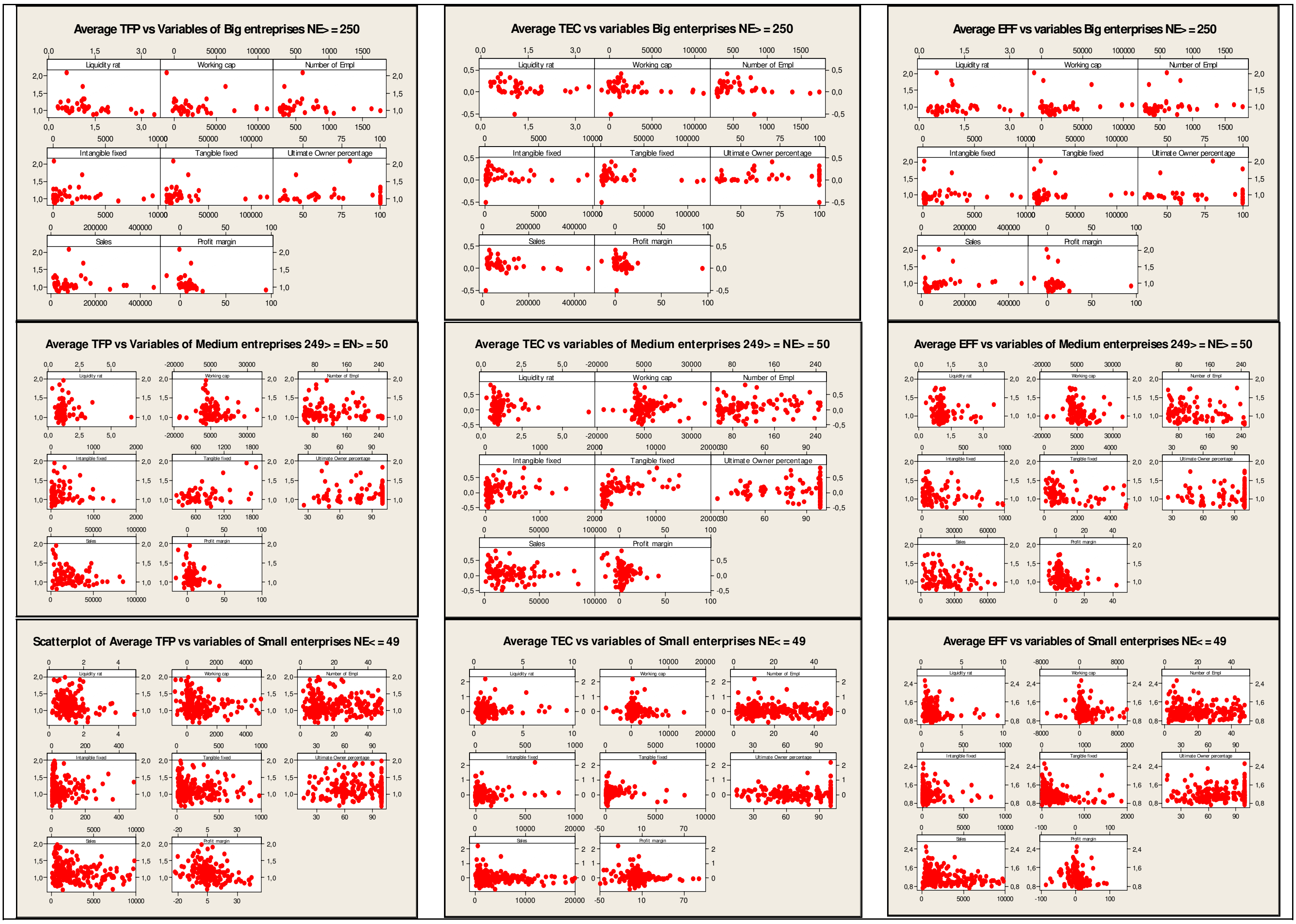
Looking at the total averages[7] of the three tables we notice that the score of technological change is higher for big firms (0.09) and lower for medium and small firms (0.075 and –0.002). However, looking at the total average of efficiency change (EFF) we notice the exact opposite results. The highest EFF scores (1.37) are obtained by the small size firms while the medium size firms have an efficiency change score of 1.14 and the big size firms of 1.01. As it can be seen, big size firms due to R&D and capital capabilities have an advantage over the medium and small size firms of utilizing and creating technological advances and thus a competitive advantage related to superior technology. However, due to their flexibility small and medium size can utilize better and thus more efficiently their resources from the larger firms. Thus they have higher efficiency change scores (EFF) from larger firms.

In general, a main question in our study is how the variables under examination interfere to firms' TFP, EFF and TEC performance. Moreover, how the size and the needs of firms differentiate towards those variables and what are the main factors influencing their EFF and TEC performance. At figure 3 we plot the average values of the variables under consideration (LR, WC, NE, IFA, TFA, UOP, SA and PM) against TFP, TEC and EFF and then we classify them according to firm size.

Table 4 illustrates the results of the graphs illustrated on figure 3. The technological change (TEC) for big size firms is mainly based on the number of employees (NE), the value of firms' tangible fixed assets (TFA) and profit margin (PM). Whereas for the medium size firms' liquidity (LR), working capital (WC), intangible and tangible fixed assets (IFA and TFA), ownership (UOP) and profit margin (PM) have a positive effect on firms' technological change. Finally, for small size firms LR, WC, TFA and PM seem to have a positive effect.

Looking now at the efficiency change of big firms we notice that a positive effect on their efficiency is mainly upon their IFA, TFA, SA and PM whereas for the medium size NE, IFA, TFA and UOP are produced firms' positive influence. Finally, only three variables play a major role for the positive influence on their efficiency change and these are the WC, the IFA and the UOP. In general, total factor productivity of big size firms is based on NE, TFA, SA, and PM, while for medium size firms on LR, WC, IFA, TFA, UOP, SA and PM. Moreover, for small size firms total factor productivity is based mainly on LR, on WC, on IFA and on the UOP.

Figure 3: Scaterrplots of the variables vs TFP, TEC, EFF, categorized by the size of the firm



In conclusion, foreign ownership seems to play a major role for SMEs' influencing their productivity through transfer of knowledge, skills, technology etc. taking advantage of economies of scope; while big firms increase their productivity through strategies of resource seeking, taking advantage of economies of scale (Rumelt 1982, Dunning 1979, 1980, 1988ab, 1995, 2001; Dunning and Bansal 1997).

Table 4: Correlations of variables vs TFP, TEC, EFF categorized by the size of the firms.

	LR	WC	NE	IFA	TFA	UOP	SA	PM
TFP BIG	-	N/C	+	N/C	+	N/C	+	+
TFP MED	+	+	N/C	+	+	+	+	+
TFP SMA	+	+	N/C	+	-	+	-	N/C
TEC BIG	-	N/C	+	-	+	N/C	-	+
TEC MED	+	+	N/C	+	+	+	-	+
TEC SMA	+	+	N/C	-	+	N/C	-	+
EFF BIG	N/C	N/C	N/C	+	+	N/C	+	+
EFF MED	N/C	N/C	+	+	+	+	-	-
EFF SMA	N/C	+	-	+	-	+	-	N/C

N/C indicates that there is not an obvious relation between the variables under consideration

4. Conclusions

In this paper using a number of variables like the number of employees, the foreign ownership, the profit margin, sales, intangible and tangible assets, working capital and the liquidity ratio, we evaluated their influence on firms' productivity and competitive advantage. Relying on a sample of 395 firms with foreign ownership operating in the Greek manufacturing sector, we have analysed according to firms' size the effect of the variables under consideration. For this purpose, the Malmquist productivity index and its decomposition to technological and efficiency change were used in order to determine the key factors influencing firms' total productivity and technological and efficiency change.

As our analysis reveals, the size of the firm determines the factors influencing, in most of the cases, firms' productivity and competitive advantage. Specifically,

1) For big firms:

- Firms' number of employees, possession of total fixed assets, sales and profit margin, positively influence total factor productivity.
- Firms' number of employees, possession of total fixed assets and sales positively influence technological change.

- Efficiency change is positively influenced by firms' possession of intangible and tangible assets, sales and profit margin.

2) For medium size firms:

- Total factor productivity is positively influenced by firm's liquidity ratio, working capital, possession of intangible and tangible assets, foreign ownership, sales and profit margin.
- Technological change is positively influenced by firms' liquidity ratio, working capital, possession of intangible and tangible assets, foreign ownership and profit margin.
- Firms' number of employees, possession of intangible and tangible assets and foreign ownership, positively influence efficiency change.

3) For small firms:

- Total factor productivity is positively influenced by firm's liquidity ratio, working capital, possession of intangible assets and foreign ownership.
- Technological change is positively influenced by firms' liquidity ratio, working capital, possession of tangible assets and profit margin.
- Efficiency change is positively influenced by firms' working capital, possession of intangible assets and foreign ownership.

As can be concluded, the factors influencing firm's productivity, efficiency and technological advantages differ according to firms' size. Moreover, these factors are determined by firms' needs and corporate strategy. The results of our research support internalisation theories, which suggest that firms use different internalisation strategies to enter foreign markets in order to increase their productivity and obtain a competitive posture.

However, due to the fact that we are using secondary data and we are excluding measurement of the environment under which the firms are operating the results must be treated with care and need to be considered along with other studies of productivity and internationalisation in order for the reader to understand better the factors and the conditions influencing firms' productivity and competitive advantage relative to their size.

Endnotes

1. Lately, John H. Dunning has also begun to explore the likely impact of the growing importance of relational (R-) assets — the willingness and capacity of a firm or persons within a firm to conduct on behalf of that firm beneficial relations, both with other persons within the firm and between themselves and persons in other institutions. Such advantages are often cumulative and arise from previous or current dyadic or network relationships (Dunning 2001).

2. ICAP directory provides financial data (based on published accounts) for all Plc. and Ltd. firms operating in Greece. *http://www.icap.gr/isologismoi/intro/login/index.asp*.

3. According to EU definition of firm size big firms are considered those with more than 250 employees, medium firms those with 50 to 249 employees and small firms those with less than 50 employees.

4. Due to the enormous quantity of results we are not presenting the names and sub-sectors, in which the firms are operating, neither the results of TFP, TEC and EFF separately for the years 95-96, 96-97, 97-98, 98-99, 99-00 and 00-01. However, this information is available to the readers upon request.

5. Firm size as indicated previously is measured by the number of firms' employees.

6. Some of the well-known firms belonging to table 1a (big firms with more than 249 employees) are Coca –Cola Hellening Bottling Company S.A. (DMU 1), Heracles General Cement Co. S.A. (DMU 2), Nestle Hellas S.A. (DMU 7), Aluminium de Grece S.A. (DMU 3), Club Mediterranee Hellas S.A. (DMU 90) and so on. Some medium size firms presented in table 1b (50-249 employees) are Minerva S.A. Edible oils enterprises (DMU 49), Eltrak S.A. (DMU 59), Beiersdorf Hellas A.G. (DMU 54), Bristol-Myers Squibb Ltd (DMU 21), Faiax S.A. (DMU 116) and so on. Lastly some small size firms (<50 employees) presented in table 1c are Hilti Hellas S.A. (DMU 201), Palco S.A. De tricotage (DMU 159), LLOYD'S Register S.A. (DMU 192), FIAT Credit Hellas S.A. (DMU 13), IDEAl Group S.A. (DMU 295) and so on.

7. Table 1c has two total averages. The first one includes all the small size firms under examination. However, if we subtract 8 small size firms with exceptionally high scores (a/a-DMU: 392-384, 389-297, 372-295, 352-309, 292-267, 282-177, 280-338 and 232-269) the total average values of TFP, TEC and EFF are quite different and according to our opinion more representative to the sample under examination

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