«ΣΠΟΥΔΑΙ». Τόμος 52. Τεύχος 1ο-2ο. (2002). Πανεπιστήμιο Πειραιώς / «SPOUDAI», Vol. 52, No 1-2. (2002), University of Piraeus

DOMESTIC AND FOREIGN COMPANIES IN GREEK MANUFACTURING SECTOR: COMPARATIVE PERFORMANCE ANALYSIS MULTINATIONALITY AND FIRM GROWTH

By

Argiro Moudatsou
Heraklion Chamber of Commerce and Industry

Abstract

This paper concerns a comparative performance analysis of Greek and foreign (multinational) firms in Greek manufacturing sector regarding evolution of market shares, profitability and firms growth. For the analysis have been used data from balance sheets of two different group of companies (greek and foreign). In the two groups are included the most important manufacturing firms as it regards their size and market power. The comparison of the evolution of market shares for the period 1988-1994 indicates that foreign companies even though are the minority in each branch they dominate the branches were they activate in terms of market share. This happens because they possess some firm-specific advantages over their domestic competitors and is in accordance to the multinationals' (MNEs) theory.

Against the traditional MNEs theory though, is the profitability issue since the analysis by branch (using regression methods) and the analysis for the manufacturing sector as a whole (using Analysis of Variance methods) showed that foreign firms are not more profitable than their domestic competitors and that ownership (domestic or foreign origin of the firm) does not affect firm's profitability (even though the theory asserts the opposite argument). This could happen because MNEs use other methods to transfer their profits abroad (e.g. transfer pricing is a most favourite strategy for profit remittance)

Against traditional MNEs theory are also the results from firm's growth analysis since it was proved that ownership does not affect firms rate of growth, so the MNEs does not possess any advantage to grow faster than non-MNEs as theory states.

JEL classification: F21, F23, L1, Keywords: Foreign Direct Investment, Multinationals, Market Performance.

1. Introduction

International production financed by foreign direct investment (FDI), as the most important form of international economic involvement is fairly

new. Until the World War II, the value of international production was only one third that of international trade.

In mid-1950 and 1960, the growth of foreign production outpaced that of trade, in spite of trade liberalisation and by 1970 had exceeded that of trade in total. Where the FDI provides resources to a host country which enable them to produce goods more cheaply than could have been imported (exclusive of tariffs or other import duties), then it acts as a superior substitute of trade.

On the other hand, the terms on which these resources are provided and the control over the way in which they are actually deployed, may impose a cost unacceptable to host country. This cost has to do with the FDI's negative effects on host economy. As foreign direct investment involves a transfer of a whole package of resources and proprietary rights across frontiers, a stream of costs and benefits is expected to be realised.

However, while it is recognised that costs and benefits are involved for both, the investing and host countries, the form of the relationship is far from precise. It has been argued that the relationship arising out of this process between the two parts, is one of non-zero sum game in which both parties can gain or lose, but one gains/lose does not necessarily mean that the other lose/gain (as would be in the case of zero-sum game).

As the key feature of direct foreign investment is that is provides the recipient nation with a "package" of knowledge, capital and entrepreneurship, it can be assumed that there will be a positive contribution of FDI to economic growth and development in host countries. But there are costs as benefits associated with inward direct investment. For example, the repatriation of profits to the parent company may cause balance of payments difficulties for the host state; MNEs may use their monopoly power to exploit host country consumers; host governments fear a loss of economic independence as decision - making resides with corporate managers abroad, and so on.

The effects of foreign direct investment on the economies and societies of the receiving countries can be classified into economic, social and political.

The issues raised vary from the rather technical balance-of-payments problems to questions of national sovereignty, and in relation to the latter it is not only developing nations that are concerned at the danger of foreign

domination. Such concern is also expressed in many industrialised countries acting as hosts to foreign investment. For example, both Canada and Australia have voiced their fears that the huge inflow of foreign capital may lead to a reduction in national independence. This is due to the realisation that FDI may erode the power of the host nation, as the bigness of multinational firms places them, to an extent, above and outside the control of the law.

The social issues are mainly concerned with the creation of a foreign "elite" in the host countries and the impact they can have to the locals. Such social issues are likely to arise and be more pronounced where there is a difference in the economic, social and cultural backgrounds between the investing and host countries. Generally speaking, the economic effects of foreign direct investment can be distinguished into macro and micro ones. The micro influences of FDI are related to structural changes in economic and industrial organisation. They have to do with the creation of a more competitive environment or conversely with the worsening of monopolistic and/or oligopolistic elements in the host economy.

Macro effects can further be divided into primary and secondary linkages.

Primary linkages are associated with growth, output, employment, balance of payment, productivity, technological know-how, training of labour and management etc.[1]

Secondary linkages are essentially interindustry linkages and are related to the way in which FDI integrates or not with the local economy through. For example, FDI can integrate to local markets through locally produced materials and components or through the attraction of new industries, which can complement the activities of the pioneers in the host countries. This is the case with most foreign investment in service industries such as banking, insurance and brokerage which follow other industries, particularly those in the manufacturing and mining sectors, but also foreign suppliers of components and materials.

The combined influence of the micro and macro effects on the host economy is realised through the generation of the streams of future costs and benefits, associated with the investment. Benefits accruing to the host country can be distributed through tax payments, lowering of output prices, improvement in the quality of output, increase in the income of local factors

of production and finally through the increase in productivity, output and employment.

Besides the above, the international production has other effects too: while trade normally takes place between independent economic agents, international production, financed by FDI, involves no change in ownership. In trade, buyers and sellers have competing goals; in international production, producing affiliates seek to meet the goals set by their parent companies (MNEs). These differences are likely to be most pronounced whenever international production gives rise to economies of integration and where its ownership is concentrated on the hands of a few large firms. MNEs in some sectors have acquired a dominating position in high technology industries (computers, industrial instruments, chemicals and so on). In Less Developed Countries (LDCs) they control or possess raw material resources (oil, copper, aluminium) or have been dominant in insurance, banking, tourism.

In Greece foreign direct investment, through multinational enterprises originates in the early of 1950s with the enactment of special legislation promoting and protecting foreign capital. Starting point for all theories of FDI and MNEs is that they must possess some advantages not shared to their local competitors. These advantages must be specific to the firm and transferable only within the firm and across distance; these are called firm-specific advantages. There must be also, some other factors that affect the decision of a firm to produce abroad. Some of them are: relative production costs, trade barriers, market characteristics; these are called location specific factors. The above two set of factors, firm-and location-specific factors, represent the essential conditions for multinationality and form the basis for the theories of FDI evolving in the literature.

In this article have been examined some aspects of performance of Greek and foreign firms that activate in the same industrial branch using empirical data from balance sheets of a sample of Greek and foreign companies. This article is divided into six sections.

The first section (introduction) is referred to a brief review of the theory of FDI and multinational enterprises.

The second section is referred to methodological issues and sources of data.

The third is referred to the profitability and ownership effect presenting the analysis by branch results. In the analysis by branch we would like to check first, if ownership does affect the profitability of Greek and foreign industrial firms and if MNEs have an ownership advantage over domestic firms, regarding profitability.

The fourth is referred to the comparison of probitability between two different types of firms which was made by using also the AOV (analysis of variance) method for the Industrial Sector as a whole (all branches together).

In both cases the results showed that there is no difference in profitability of two different type of firms, that means that there is no ownership advantage of foreign firms over Greek firms. In this case the traditional MNE theory has not been verified. This is not unusual since such results have been found also, in many other studies concerning the MNEs activity in different developing countries.

The fifth is referred to firm growth and multinationality. The results about ownership and firm growth were in contrast to MNEs theory since the empirical evidence from Greek industry showed that ownership does not affect firms growth. (There was conducted a regression analysis at yearly base, which aggregate data of manufacturing sector for the period 1988-1994)

The sixth and final section is referred to the conclusions.

2. Methodological issues and data sources

2.1. About the data

The data for this study were derived from a database of ICAP, a private organisation that gathers and publishes financial data from balance sheets of enterprises of all Greek economic sectors. I used information from the database of the above organisation because there are no official publications with economic data concerning the foreign companies that are established in Greece. The only official data about foreign capital are that which are keeping by the Bank of Greece in aggregate level (That is, imported foreign capital accounts in various sectors of Greek economy, but nothing on firm level because such data are concerned as confidential). Nevertheless, the above data are compiled from:

a) questionnaires prepared especially for this purpose

b) private interviews and

c) The Government Gazette

The data under considerations concern individual industries of some branches of the Greek manufacturing sector. These branches were chosen according to the "foreign presence criterion" that is the participation of foreign companies to the branch activities.

In each branch are classified only the 15 (Greek and foreign) largest firms rancked by total assets.

The foreign companies were chosen using the foreign majority of the companies' share as the criterion The foreign majority in the sample firms exceeds the 50% up to 100%, so they are "pure" foreign owned. The shares of ownership of these companies are declared and keeping in special tables published by the Bank of Greece as "imported capital accounts". Comparing the tables of Bank of Greece with that of ICAP we chose the foreign companies in each branch. The rest of them in each branch are Greek owned companies.

Each firm is classified in each of 14 industrial branches.

Profitability is measured by the ratio: gross profits/total assets

2.2. The methodology

For examing the issue of different performance (in terms of profitability) of foreign and domestic companies two approaches were used:

First the analysis by branch and

Second the comparison of averages of the two type of companies for all manufacturing branches (through the Analysis of Variance method) regarding them at aggregate level

What is the rationality of the two different approaches?

The purpose was, using data from balance sheets of specific firms, to detect the ownership effect on the profitability. In other words, to detect if the multinationals are more profitable than their local competitors.

Profitability can be affected by two different group of factors: The one group is related to branch characteristics and is common to all companies in the same branch and the other is related to firms' policy which differentiates between domestic and foreign firms.

So, the target of the first method was to check the ownership effect separately for each branch so that to isolate the "effect" since some of the investigated branches may be more profitable than others independently of the nationality of the firm. The problem here was that the samples were too small (according to available data) so the degrees of freedom were few and this had an influence on reliability of the results.

In the second method, the comparison of profitability between two groups of firms (Greek and foreign) concerned all industrial branches. The sample size in this case was sufficiently large so the results were reliable.

2.3 Description of estimation process

In the analysis by branch, attempting to examine if the ownership has an influence on firms profitability the formula $Yi=a+bDi+e_i$ (1) was used. Y_i is the profitability and Di is the dummy variable to "catch" the ownership effect. Di=0 for Greek firms and 1 for foreign firms, e is the error term. The profitability (Y_i) of each firm is measured by the ratio: Gross profits / total assets.

Dummy variables are usually used in regression models in order to express the qualitative explanatory variables. Such models that contain exclusively dummy variables are called AOV (Analysis of Variance) models. In economics such models are not common (as in sociology, education and market research) Typically, in most economic research a regression model contains some explanatory variables that are quantitative and some that are qualitatives.

The kind of these models are called ACOV (Analysis of Covariance) models. In the present case in lack of data measuring the firm's nationality or better the firm's multinationality to distinguish between local and foreign[2], the only way to "catch" the effect of ownership (nationality) was to use dummy variable. The same method was used by another researcher Lall Sanjaya[3] who has compared the profitability of MNEs and local firms for a sample of 109 manufacturing companies in India and Colombia using the

same method. He comes to the conclusion that the declared profits of MNEs and local firms do not differ significantly from each other.

In order to remove the branch effect, each firm's profitability (Y_i) was removed from the branch's average profitability ($\Sigma Yi/n$).

Then for each 14 branches the model $Yi=a+bDi+e$ was estimated using cross-section (data on firms level) and time series (data on the same firms for seven years period)The investigation period was 1988-1994. For each of seven years (1988-1994) we had 15 observations (the largest 15 firms ranked by assets). That is, fore each branch 7 equations were estimated, one for each year from 1988 to 1994.

The most appropriate estimation method in such cases when pooling data are used is the Seemingly Unrelated Regression (SUR) method.

In fact this method is an application of generalised least squares proposed by A. Zellner[4]. The idea is that, as we estimate equations refered to different firms the explanatory variable will not be identical for each firm and there may be non user correlations between the disturbance terms of equations. So we have to estimate a set of $m=7$ equations $y_i=\beta_i X_i+u_i$ $i=1.2...m.$ with $b=(X'\Sigma^{-1} X)^{-1} X'\Sigma^{-1} y$, where Σ is the variance — covariance matrix for u. Each term in principal diagonal of Σ is a n x n variance — covariance matrix for the disturbances in each of the ith equations. In fact, Zellner proposes to apply the OLS in each equation separately and use the estimated residuals as terms of Σ matrix. From the matrix is calculated the Σ^{-1} matrix and then apply the formula $b=(X\Sigma^{-1} X)^{-1} X\Sigma$-1 y. with $var(b)=(X\Sigma^{-1} X)^{-1}$ to estimate the regression coefficient b.

The elaboration of data was carried out by using the statistical program "RATS 386".

3. Market-share analysis by branch of Greek and foreign companies. Profitability and ownership effect. 1988-1994

3.1. General trends in Greek manufacturing in period 1988-1994

Because some results of our research are ambiguous possibly because they are affected by the general situation of economy and market, we present here the general trends of Greek manufacturing, before we proceed to the analysis by branch.

From financial data based on an analysis of Balance Sheets of industrial corporations (SA) and Limited Liability companies (L.L.C.) covering all sectors[5] with a sample of about 3500 companies the following general trends of Greek manufacturing are realised.

From 1986 to 1990 there was a net improvement in the financial net results of Greek industrial companies. The most dynamic sectors were *basic metals, chemicals and beverages.* At the same time the sectors with the biggest declared losses were *textiles, transport equipment and metal products.*

1991-1994: The Greek manufacturing stagnated. The decline in overall profitability was attributed to large increase in financial and other operating expenses. Especially in 1992, dramatic changes due to Governments policy were happened which aimed to reduce the public sector. this policy has as result the closure of several loss making manufacturing companies and to privatisation of many others. Despite of that, profitability was improved the last year (1994) in some sectors like *food and electric-electronic equipment.*

3.2 Evolution of market-shares of Greek and foreign companies. Analysis by branch

In the analysis by branch, only some branches of the Greek manufacturing sector are included and the data concern individual industries. These branches were chosen according to the "foreign presence criterion" that is the participation of foreign companies to the branch activities.

In each branch are classified only the 15 largest firms ranked by total assets. These 15 largest companies represent the 80% of total branch sales, so we concern them as the most representatives of each specific sector.

The foreign companies were chosen using as a criterion the foreign majority of the companies' shareholders. The foreign majority in the sample firms exceeds the 50% up to 100%, so they are "pure" foreign owned. The shares of ownership are declared by the Bank of Greece and are keeping in special tables as "imported capital accounts". Comparing the tables of Bank of Greece with that of ICAP I made the final choice of foreign companies in each branch. The rest of them in each branch are Greek-owned companies. Each firm was classified according to its activity in one of 14 industrial branches. The branches and the market-share of each group of

companies (domestic-foreign) are presented on the appendix table 1 and the companies' classification by branch on table 1a.

The **general conclusion** regarding the evolution of market shares in all branches under research (except Food, Textiles, Rubber and Plastics, Fabricated metal products, Electric-electronic materials and Appliances and Transportation equipment) was that foreign companies possess higher shares than their domestic competitors and this share in some branches exceeds the 50% of total branch sales even though the number of them in each branch is too small. (They represent the 30% of the total number of companies in each branch)...

Even though the Greek competitors of MNEs in each branch are more and of comparable size, the foreign have much greater market shares That happens because they possess some specific advantages.

These advantages are called firm-specific advantages and are described as technology, information knowledge, intangible capital and know-how. Reflecting the definitions given, technological advantage is seen in a fairly broad sense to include production secrets, management organisational techniques and marketing skills. New products and production processes are the most tangible component of MNEs technological advantage but there are other aspects which may be at least equally important. In particular, the ability to differentiate products may be highly significant particularly where technology becomes complicated. By means of "minor physical variations", "brand names" and subjective distinctions created by advertising or differences in the terms and conditions of sale, the product may be protected from exact imitation. Production differentiation is, in turn, a reflection of more general managerial skills. The functions of marketing research, selling, advertising and promotions are all necessary to the attainment of customer loyalty (the success of American firms such as Kellogg, Coca-Cola, Heinz, Proctor and Gamble is based to a much greater extent on marketing expertise than on laboratory R & D) .

Another source of technological advantage may lie in the superior organisational skills and management techniques of MNEs as compared with local competitors. The advantage may arise from better-trained or educated, or more experienced managers. Alternatively, superior organisational structure may facilitate more rapid and more efficient decision-making. Or again, management techniques, in areas such as finance, may be more sophisticated;

such factors may help explain, for example, the growth of international hotel chains such as the Hilton, Intercontinental, Sheraton, etc. Various authors have stressed certain characteristics of knowledge pertinent to an explanation of why MNEs choose international production rather than exporting or licensing. Knowledge has the characteristic of a "public good" to the firm. That is, once the know-how has been achieved, foreign subsidiaries can use it without any additional cost to the parent company. The know-how might thus be made available to the subsidiary at a low cost whereas the competitive domestic firm would have to bear the full cost of obtaining the information. For this to be important in promoting direct investment, however, the MNE must be able to earn a higher return by retaining the knowledge within the firm itself. An additional point suggested in relation to knowledge about product differentiation is that it cannot easily be separated from the production process or the marketing activity of the firm. More generally, a knowledge advantage must be easily transferable within the firm and across national boundaries, but less easily transferable between different firms whether in the same or in different countries.

All the above justify the result of the market share analysis, that foreign companies dominate the branches where they activate.

3.3. Profitability and ownership effect-Regression results by branch

The operation of domestic and foreign companies has occupied the international bibliography extensively in the past. Most of the researchers have examined the different operation of foreign (and mainly multinational) companies in relation to domestic companies attempting to answer the following questions

1) Are multinational firms more profitable than their domestic competitors as is supported by MNEs theory or not?

2) What factors affect the profitability of the two types of companies? Are these factors different or similar?

3) Do foreign firms apply different policies compared to domestic firms or are there similarities in their behaviour?

4) Do multinational firms enhance the economic development of developing countries or not?

The failure of these studies to draw up conclusions is due to the following main reasons

a) The lack of adequate data and

b) the inability of measuring the effect of the function of these companies on host countries (Lall 1978)

The picture that emerges from cross section studies is a confused one and even it is generally acceptable that there are differences in their behaviour, there are still major different opinions over how these should be interpreted.

The comparison of the two different type of companies (foreign and domestic) in the literature comes to the conclusion that foreign companies operate more profitably. This general view may lead to wrong conclusions if we do not take into consideration that the satisfying operation of these companies may be due to other factors. It is quite possible that their higher profits could be due to the fact that these companies undertake a higher risk and are of larger size (if we assume that profit is related to size) or that great entry barriers exist in the markets where the foreign firms are more profitable than local firms.

In so far as Greek economy is concerned various studies have come to the conclusion that MNEs are more profitable than their domestic competitors.[5α]

In the present work I tried to answer the question of profitability by using two different approaches. First by using the model $Y = a + b\,Di + e_i$ and the method which is described in section 2, I checked if ownership itself influences the firms' profitability. The profitability (PRi) of each firm is measured by the ratio gross profits / total assets. For each branch 7 equations were estimated, one for each year for the period 1988-1994 using the SUR method (Seemingly Unrelated Regressions:The method is described in section 2, above). The results by branch are presented on tables 2-15 in the appendix.

3.3.1. Interpretation of the regression results

Coefficient a, gives the mean profitability of Greek companies, the basic group, and the coefficient b, shows by how much the mean profitability of a foreign firm differs from the mean profitability of a Greek firm.

The zero hypothesis (Ho: a=0 and Ho: b=0) was tested by the t — statistic at 5% significance level.

Statistically not significant a means, that the profitability of Greek firms has not been changed through the seven years while statistically not significant b means that there is no difference is profitability of Greek and foreign firms, that is, the ownership does not play any role on firm's profitability.

The explanatory power of the model for all equations in all investigated branches was very low (low prices for R) but this was expected since we use only one explanatory variable. This fact is not very important since our intention is to examine if ownership does really affect profitability as is supported by the theory and not to examine all the factors that really affect profitability.

The Durbin-Watson d-statistic is used to testing for autocorrelation in the residuals since we use time-series (seven years period). For all equations in all branches the computed d-values at 5% significance level are greater than d_u critical values. So we can not reject the Ho hypothesis that there is no positive autocorrelation.

General result: ownership in most branches does not affect firm's profitability. (Coefficients b, not significant). In other words the above result indicates that ownership does not matter even though the MNEs theory asserts the opposite argument.

4. Comparing the profitability of domestic and foreign firms in Greek manufacturing by Analysis — of — Variance of the two groups of companies

Another way of checking the relation between profitability and ownership effect is by comparing the profitability of domestic and foreign companies for the period 1988-1994 by using Analysis — of — Variance methods regarding the manufacturing sector as a whole (all branches together). Besides, analysis by branch in section 2, might create problems because of the small number of observations in each branch. The Analysis — of — Variance method is a method of estimation of variance of the two sub-groups and the comparison of them in order to establish whether the difference between two variances is statistically significant (F-statistic value).

So, the data of 120 (greek and foreign) firms were pooled together. Criterion for including a firm in the sample was the size of firm's total assets. Profitability was measured as a ratio: gross profits / total assets. The

Source of variation (1)	Sum of squares (2)	Degrees of freedom (3)	Mean square (4)=(2):(3)	F statistic (5)
Between the Samples	1314.69	n1=k-1=2-1=1	1314.69	F^*=1314.69/ 361.98 =3.63
Within the samples		n2=N-k=134-2=132	361.98	$F_{0.05,(1.132)}$=3.92 $F_{0.01,(1.132)}$=6.85

Source of variation (1)	Sum of squares (2)	Degrees of freedom (3)	Mean square (4)=(2):(3)	F statistic (5)
Between the Samples	1263.07	n1=k-1=2-1=1	1263.07	F^*=1263.07/359.20 = 3.52
Within the samples		n2=N-k=131-2=129	359.20	$F_{0.05\ (1.129)}$=3.92 $F_{0.01\ (1.129)}$=6.85

Source of variation (1)	Sum of squares (2)	Degrees of freedom (3)	Mean square (4)=(2):(3)	F statistic (5)
Between the Samples	1070.04	n1=k-1=2-1=1	1070.04	F* = 1070.04/391.52=2.73
Within the samples		n2=N-k=131-2=129	391.52	$F_{0.05\ (1,124)}$=3.92 $F_{0.01\ (1,124)}$=6.85

Source of variation (1)	Sum of squares (2)	Degrees of freedom (3)	Mean square (4)=(2):(3)	F statistic (5)
Between the Samples	2128.65	n1=k-1=2-1=1	2128.65	F* 2128.65/524.077=4.06
Within the samples		n2=N-k=128-2=126	524.077	$F_{0.05,(1,128)}$=3.92 $F_{0.01,(1,128)}$=6.75

Source of variation (1)	Sum of squares (2)	Degrees of freedom (3)	Mean square (4)=(2):(3)	F statistic (5)
Between the Samples	1427.54	n1=k-1=2-1=1	1427.54	F* = 1427.54/649.39= 2.20
Within the samples		n2=N-k=124-2=122	649.39	$F_{0.05,(1,22)}$=3.92 $F_{0.01\ (1,122)}$=6.85

Source of variation (1)	Sum of squares (2)	Degrees of freedom (3)	Mean square (4)= (2):(3)	F statistic (5)
Between the Samples	591.49	n1=k-1=2-1=1	591.49	F^* = 591.49/464.99=1.27
Within the samples		n2=N-k=117-2=115	464.99	$F_{0.05,\ (1.115)}$=3.92 $F_{0.01,\ (1.115)}$=6.85

Source of variation (1)	Sum of squares (2)	Degrees of freedom (3)	Mean square (4)=(2):(3)	F statistic (5)
Between the Samples	202.24	n1=k-1=2-1=1	202.24	F^*=202.24/1731.70 = 0.12
Within the samples		n2=N-k=114-2=112	1731.70	$F_{0.05,(1.112)}$=3.92 $F_{0.1,\ (1,\ 112)}$=6.85

5. Multinationality and firm growth. Comparing Greek and foreign manufacturing companies. The managerial model of firm growth

Neo - classical theory fails to provide a satisfactory explanation of the growth of the firm. Its assumptions of individual firms operating in undifferentiated markets with identical knowledge and technology and no economies of scale leave no basis for distinguishing individual firms or for predicting which will grow faster. On the other hand though, there is one school, which has examined the determinants of firm's growth in the framework of modern oligopolistic competition conditions; that is the "managerial school". The main vehicle for growth for the modern oligopolistic corporation is diversification into new products. Diversification faces three types of constraints[7]: demand, supply and management.

The demand constraint can be eased by improved marketing of existing products and the innovation and promotion of new products.

The supply constraint, which deals with the availability of finance to undertake demand-increasing measures, depends on a complex interaction between profitability and growth via the stock-market valuation of the firm.[8] It seems generally accepted that there is a non-linear relationship between profits and growth both increasing together to a certain level and then going in opposite directions. However, the inverted U-shaped curve itself can shift outwards because of diversification so that a successful firm may be able to combine profitability with growth for sustained periods. The sign of this variable is therefore difficult to predict.

The managerial constraint arises from the costs of assimilating new managers or those of control and communication in larger organisations[9]. This constraint is generally supposed to cause a negative correlation between growth and the initial size of the firm. It is widely held that amongst large firms the most successful are those, which have developed or are developing an efficiently integrated international network of production facilities. The literature about business strategy has spoken of a shift amongst multinational corporations (MNEs) away from systems of independent locally oriented affiliates towards global or rationalised networks. In a broad range of industries such integrated strategies are believed to confer an advantage on MNEs improving their performance (as measured by the growth of the firm) to other firms. Each affiliate specialises its activities according to specific characteristics of local supply (or production conditions encompassing

the types of skill, experience, organisation and resources that prevail in a given location) and demand (comprising consumer tastes and user requirements).

Exploiting the locational differentiation of supply and demand in an integrated corporate network is also associated with economies of scale through the local concentration of particular activities and economies of scope due to international co-ordination of related but geographically separated activities. The experience acquired in a specialised activity in one location creates technological and other slipovers than can be provided to other parts of the MNE network elsewhere.

So, MNEs possess the advantages to grow faster than non-multinational firms. Even though the impact of multinationality on growth was not explicitly analysed in the MNE literature it was shown that international investment was depended crucially on the possession of certain monopolistic advantages[10] (mainly innovation and product differentiation) which were identical to the determinants of growth in managerial literature. Further these advantages were primarily possessed by the largest firms in each industry (Horst 1972) partly because of scale economies in such activities and partly because size confered monopolistic benefits of its own. (In terms of privileged access to capital markets, better market information, greater entrepreneurial resources more bargaining power and the like).[11]

At this point, we shall review previous studies of the growth performance of MNEs. These studies are refered to the relationship between size and growth regarding different countries but none of them has provided an analytical framework for explaining this relationship.

The first set of studies (Hymer and Rowthorn 1970 and Rowthorn and Hymer 1971) tried to test whether US MNEs had distinct advantages over others. The authors related the growth of sales of their sample (200 to 500 firms from different advanced countries) to the log and the squared log of sales and introduced two sets of dummy variables to isolate the influence of industry and nationality factors. They found a U-shaped relationship between size and growth. The rising segment applied only to a few giants: the most of the large firms in the sample size had a negative effect on growth[12]. No theoretical explanation was provided for testing this U-shaped curve. The authors also found that US firms did not grow faster than

Continental or Japanese rivals. They did not attempt to examine the influence of multinationality, as such, on growth.

A second study was by Buckley-Dunning and Pearce (1978), who conducted a similar exercise (and also included profitability as second dependent variable) with later data and a larger sample (over 600 firms). They introduced a separate variables for multinationality (foreign sales as percentage of total firm sales) besides using the previously tested variables for size industry and nationality. For the two sets of data (for 1962-67 and 1967-72) they also found a U-shaped relationship between size and growth rate (though the quadratic term was not significant for the period 1967-72). Thus, it was concluded that growth might slow as firms grow to a certain size but after this critical point for the largest firms there may be stimuli to further growth. The nature of the "stimuli" was not explained. The multinationality variable in Buckley gave inconclusive results. The authors had hypothesised though without providing theoretical underpinning that multinationality would exercise a positive influence on growth. Their statistical tests have shown that such an influence did exist for the period 1967-72 for all firms and JS firms but not for these firms for 1962-72. The hypothesis thus received nly weak support. Part of the reason may have been that the multinationality 'ariable was calculated from data for the terminal year 1972, when the model called for its calculation in the base year. The authors suggested that a correctly based variable might have shown a more unequivocal positive influence on growth.

Another study by N.S. Siddharthan and Sanjaya Lall [13] explores the determinants of growth of the 74 largest MNEs in manufacturing industry during 1976-79 along lines suggested by models of firm growth of the managerial school. The dependent variable of their model was the growth of sales during the period under study. The independent variables were advertisement intensity for each firm the research and development expenditures, firm size, profitability, degree of multinationality, minimum economies of scale and a dummy variable to distinguish between firms in consumer-goods branch and the rest brances of manufacturing sector. The above study has attempted to provide an analytical foundation for some relationships, which have been discussed in a rather ad hoc form in the firm's growth literature and to include an explicit consideration of how multinationality may be related to growth for the sample firms. The results gave some interesting insights into the managerial model of firm growth: diversification by advertising and innovation did seem to promote growth for non-consumer- good firms

though, for consumer-good firms high promotion expenditures seemed to detract from higher growth.

Profitability was positively related to the growth of the largest firms in the sample while size had a negative impact. The existence of scale economies enabled the sample firms to grow faster. Multinationality had a negative effect on growth in this period. Because during the period under study the US MNEs were tending to direct their attention to home country (because of exchange rate and other changes) they had high cost of readjustment. So, according to the authors opinion it is quite possible that multinatinality could have a different relationship with growth in a different period (or for different countries).

In the case of the Greek industry, this study tried to search for the relationship between firm's rate of growth, and firm's sales for the sample of Greek and foreign companies. The point was to detect the relationship between rate of growth and multinationality or, in other words, to detect if multinationality really affects the rate of firms growth.

5.1 Methodology

First, data on sales of Greek and foreign firms were pooled together.

These data are refered to a number of 118 firms for a six years period (1988-1994)

For each year a number of six equations (different specification models) were estimated using system-estimation methods.

The dependent variable in all cases was the rate of growth measured as the difference between logsales through successive years. That is the dependent variable was of the type $\log Y_t - \log Y_{t-1}$, were Y_t represents the firm's sales.

The independent variables were sales, logsales, logsales-squared and a dummy variable to catch the ownership effect. Different model specifications were used to detect the relationship between rate — of — growth and multinationaility.

The regression results are showed in the appendix tables 16 to 21.

5.2 **The** results

A general notice that held for all specifications is that the dummy variable (for catching up the ownership effect) is not statistically significant.

Another general notice is that the values of R^2 annd (R^2) are very low indicating that much of the variation of the dependent variable remain unexplained. This was expected to be so because there are many factors, which affect growth and have not been included in the models because of lack of data to construct the appropriate variables.

Because the data were cross-sectional (sales of firms manufacturing branches), heteroscedasticity was expected to be present, so Breusch-Pagan test was applied to test for it. The hypothesis test proved that there is no heteroscedasticity in the disturbance term since the X^2-value for all equations in all years (1988-1994) was less than the X^2-critical value at 0.05 and also at 0.01 significance level. Besides by using the system estimation methods this problem has already been confronted.

Starting from table 16 (equation 1) where are presented the regression results for firm's growth rate for the period 1988-1989 we notice that the specifications of type 3 and 4 give statistically significant coefficients except that of dummy variable (tests t and F), but that of type 4 gives a slightly higher R^2 - value (this may be so due to the addition of one more explanatory variable, the $\log^2 X_t$).

From table 17 (equation 2:is refered to the period 1989-1990) we take similar results as from table 16.

In table 18 (equation 3: is refered to the period 1990-1991) the results are much alike to the above results with the exception that, in the specification of type 4 the R^2-value is noticeably higher (39,97% compared to 13.95% of type 3).

In table 19 (equation 4: is refered to the period 1991-1992) the results are different than those of previous tables. The specification type 3 gives statistically significant regression coeff (t-test) but the F-test for the overall explanatory power of the model is not significant. That means we should not take the t-test as acceptable criterion. As it regards the other specification forms none of them gives statistically significant coefficients (t and F tests).

In table 20 (equation 5: is refered to the period 1992-1993) the results are much alike to those of table 19.

From table 21 (equation 6: is refered to the period 1993 - 1994) we notice that the specifications of type 3 and 4 give statistically significant

coeff. (t and F tests) and also the R^2 - value of type 4 is much higher (39.92% compared to 22.17% of type 3).

5.2.1. Interpretation of the results

From the results of the above analysis we can conclude first of all that **ownership does not affect the firm's rate of growth,** since in all specifications and for all equations of the estimated systems the coefficients of dummy variables were insignificant. This is in contrast to the traditional theory of multinationals, which describe the fast rate of growth as a firm-specific advantage accruing especially to the nature of multinationality.

As it regards the relationship between firm's rate of growth and sales in all cases it was shown **that the sales (indeed the logsales form) of current period affect the firm's rate of growth in a positive way, while log^2 sales in a negative way.** The unusual behaviour of the models for the period 1991-1992 and 1992-1993 (no explanatory power) could be asserted to exogenous factors and not to the model specifications and needs further investigation.

6. Conclusions

Foreign direct investment (FDI) through multinational enterprises as main vehicles of it, occurs whenever a company undertakes production activities across its national boundaries. On the meaning of "direct" investment, the usual interpretation would require at least 25 per cent of the share of foreign capital to be owned by the parent company.

The scope of this article is to give emphasis on some econmic effects of FDI and multinational enterprises' operation in host countries, even though there are social and political aspects that are very important and deserve close analysis and examination in their own right. More specifically some aspects of firms' performance have been examined. Through the analysis we tried to answer the following questions about MNEs operation in Greek industry.

1) Are MNEs more profitable than their local competitors?

2) Does multinationality affect the firms growth?

3) What is the penetration rate of MNEs in Greek economy?

In case of profitability, the traditional MNEs theory states that MNEs in Less Developed Host countries are more profitable than their domestic competitors, because the former possess certain oligopolistic advantages that give them an element of market power not possessed by other firm... For the purpose of the present analysis were used samples of foreign and Greek firms of comparable size and ranch specialisation. The results (regression analysis by branch and Analysis of Variance) indicate that there is no difference in profitability of Greek and foreign companies. So, the traditional MNEs' theory is not valid in this case. The empirical evidence from a variety of host (FDI recipients) countries indicates that it is necessary to be aware of the possibility that different conditions in specific countries (e.g. the terms of development strategy or the level of economic development) might lead to results controversial to relevant theory. Also the case of transfer pricing which give the MNEs the potential for undeclared profits remitted abroad should be concerned in interpreting the results.

In case of multinationality and firm's growth, because of lack of empirical data there was impossible to measure the degree of multinationality of sample firms so, instead of that we used the term of ownership (foreign-domestic). So we concluded that multinationality (ownership) does not affect firm's growth even though the theory of multinationality of a firm states that a MNE through the dispersion of its activities in many countries can exploit the advantages of this integration (lower production cost, easier access to local capital, exploitation of economies of location) and because of that can grow faster than a non-MNE firm.

Regarding the foreign penetration to Greek manufacturing sector, the analysis indicates that foreign companies dominate in key-sectors (like chemicals, petroleum) of Greek industry. The share of foreign companies to total assets and total sales of industrial sector is indicative of degree of foreign penetration.

Notes

1. See G. Petrochilos, "Foreign Direct Investment and the development Process, the case of Greece" England 1989.

2. Except of ownership, the degree of multinationality could be measured by the value of international production carried out by affiliates in other countries relative to the value of the domestic production of the parent company in its home economy. (See, J. Cantwell and Francesca-Sanna-Randaccio "Multinationality and firm growth", Weltwirtschaftliches Archiv.

3. Lall Sanjaya:/Streeten Paul: "Foreign investment, Transnationals and Developing countries, 1976.

4. Zellner: "An Efiicient Method of Estimating Unrelated Regressions and Tests of Aggregation Bias" J. Am. Statist. Association vol 57, pp. 348-368, 1962 and Zellner: "Estimates for Seemingly Unrelated Regressions Equations: Some Exact Finite Sample Results" J, Am. Statist. Association vol 58, 1963.

5. ICAP DIRECTORY, 1990-1996 publications

5a. See P.E. Petrakis, "The profitability of Domestic vs Foreign vs Technologically Dependent Industrial Companies: The Greek case" The paper was presented in 17 Annual Conference of European Association for Research in Industrial Economics, Lisboa Oct 2-4, 1990.

6. See method in details in A. Moudatsou Ph. D. Thesis "Foreign Direct Investment in Greek Manufacturing Sector", Technische Universitaet Berlin, Berlin 1999.

7. N.S. Siddhartan and Sanjaya Lall: "The recent growth of the largest US multinationals" Oxford Bulletin of Economics and Statistics, February 1982.

8. Hay and Morris 1966.

9. The dynamic costs of assimilating new managers is called the "Penrose effect" after Penrose 1959.

10. See Caves and Lall 1980

11. In an important paper, Paper (1979) shows that large firms within an industry can set up "barriers to mobility" for smaller firms and so retain large market shares on the basis of such advantages.

12. Hymer and Rowthorn (1970) state further that the statistical significance of the upward twist is not established and there is reason to suspect that fitting a different sort of curve may have led to a continuously negative relationship.

13. N.S. Siddhartan and Sanjaya Lall: "The recent growth of the largest Us multinationals" Oxford Bulletin of Economics and Statistics, February 1982.

References

Benvignati M. Anita: "Domestic Profit Advantages of Multinational Firms", *Journal of Business,* Vol 60, 1987.

Buckley and Casson: "The Future of Multinational Enterprises"

Buckley Peter / Dunning John / Pearce Robert: "An analysis of the growth and profitability of the World's largest firms 1972 to 1977" *Kyklos vol. 37,* 1984.

Buckley Peter / Artisien Patrick: "Policy issues of intra-EC direct investment. British, French and German multinationals in Greece. Portugal and Spain with reference to employment effects".

Buiges Pierre / Jaquemin Alexis: "Strategies of firms and structural environments in the large internal market", *Journal of Common Market Studies,* Sept. 1989.

Cantwell John / Randaccio Francesca Sanna: "Multinationality and firm growth", *Weltwirtschaftliches Arciv.*

Caves / Khalizadeh / Shirazi: "International Trade and Industrial Organisation: Some statistical evidence", 1976.

Caves Richard: "Causes of Direct Investment. Foreign Firm's Shares in Canadian and United Kinddom Manufacturing Industries" *Review of Statistics and Economics,* August 1974.

Chasid I. / Gatsos G.: "European Unification and Greek Industry Structure. Performance Perspectives", *Athens 1992.*

Chydnovsky Daniel: "The Challenge by Domestic Enterprises to the Transnational Corporation's Domination. A case study of the Argentine Pharmaceutical Industry", *World Development 1979.*

Dunning John (Editor) "Multinational Enterprises, Economic Structure and International Competitiveness" *Geneva 1985.*

Dunning John: "Explaining international production" *University of Reading, Oct. 1988.*

Dunning John / Robson Peter: "Multinational Corporate Integration and Regional Economic Integration", *Journal of Common Market Studies 1987.*

Georgopoulos A. "Greek and Multinational Enterprises in Foreign Sector: Differences and Similarities, *The University of Piraeus Journal of Economics, Business, Statistics and Operations Research, Jul-Dec 1995.*

Hombourg Stefen "Efficient Economic Growth" *Springer Pub. 1992.*

Hood Neil / Young Stefen: "The economics of multinational enterprises"

Hood Neil / Young Stefen: "Inward Investment and EC-United Kingdom evidence on Corporate Integration and Strategies".

Jenkins Rhys: "Comparing foreign subsidiaries and local firms in Less Developed Countries. Theoretical issues and empirical evidence", 1988.

Lall Sanjaya / Siddhartan N.S.:"The monopolistic advantages of multinationals: Lessons from foreign investment in the US" *The Economic Journal, Sept. 1982.*

Lall Sanjaya/Streeten Paul: "Foreign Investment, Transnationals and Developing Countries" 1976.

Neumann Manfred / Boebel Ingo / Haid Alfred: "Profitability, Risk and Market Structure in West Germany Industries" *The Journal of Industrial Economics 1979.*

Nunnenkamp Petr / Grundlach Erich / Agarwal P. Jamuna:"Globalisation of production and Markets" *Kielen Studien Institut fuer Weltwirtschaft.*

Roumeliotis Panagiotis: "Multinational Enterprises and Transfer Prices Policy in the Case of Greece" Athens 1978.

Willmore Larry: "The comparative performance of foreign and domestic firms in Brazil", *World Development vol 14,* 1986.

BRANCHES	Number of foreign companies (% of branch total)	Number of greek companies (% of branch total)	FOREIGNS' MARKET SHARE (% OF BRANCH'S SALES)
Food products	13,3%	86.7%	12%-14%. The foreign presence is too low and that was expected since this branch is traditionally dominated by greek firms
Beverages	20%	80%	The market share fluctuated between 67%-57%. Comparing with the small number of foreign companies we can conclude that this branch is dominated by foreign firms
Textiles	From 40% in 1988 fell to 20%	60% - 80%	61% (in 1988) to 24% (in 1994) The percentage fell dramatically may be because the most dynamic firms exit the branch during this period
Paper-Paper products	20%	80%	52%-47%
Rubber and Plastics	20% (1988) - 13.3% (1994)	80% - 86.7%	51% (1988) to 29% (1994). This fall may be due to exit of most dynamic firms from the branch
Chemicals	26.6%-35%	73.4%-65%	41%
Pharmaceuticals-Cosmetics	40%(1988) - 13,3% (1994)	60%-86.7%	63%
Petroleum - Coal Processing	6%	94%	70%
Non-metallic minerals	20%	80%	66%
Primary metal industries	20%	80%	62%
Fabricated metal products	20%	80%	27% (1988) - 30% (1994)
Electric-electronic materials	20%	80%	46% (1988) - 37% (1994)
Electric-electronic appliances	6%	94%	29%
Transportation equipment - shipyards	6%	94%	7% (1988) - 14% (1994)

	GREEK		FOREIGN	
Manufacturing Sector	**number of companies**	**(%) of total**	**number of companies**	**(%) of total**
Food industries	20	27.03	3	6.82
Beverages	3	4.05	3	6.82
Tobacco	4	5.41		0.00
Textiles	9	12.16	5	11.36
Clothing, footwear			1	2,27
Wood Cork	2	2.70		0.00
Furniture	1	1.35		0.00
Paper, paper products	2	2.70	3	6.82
Printing-Publishing	1	1.35		0.00
Leather-Furs	1	1.35	3	6.82
Rubber-Plastics	2	2.70	4	9.09
Chemicals	2	2.70	6	13.64
Petroleum-Coal	2	2.70	1	2.27
Non-metallic minerals			1	2.27
Basic metals	3	4.05	3	6.82
Metal products	6	8.11	3	6.82
Mashinery-Appliances	8	10.81	3	6.82
Electric-Electronic appliances	2	2.70	3	6.82
Transportation equipment	1	1.35	1	2.27
Miscellaneous industries	5	6.76	1	2.27
TOTALS	74	100.00	44	100.00

Dependent variable:Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	-1.987294 (-0.4991482)*	-0.9529512 (-0.2812832)	-1.522607 (-0.4534463)	-4.293.772 (-0.7597796)	-4.956279 (-0.9696889)	-6.486936 (-1.029858)	-5.430665 (0.8843466)
Di	14.29430 (1.45712055)	14.29430 (1.207647)	22.83907 (2.158726)	32.20328 (2.091884)	37.17212 (2.867688)	48.65201 (3.227726)	40.73195 (2.525686)
R^2	0.09335293	0.09054193	0.19989967	0.20399253	0.20989996	0.21433274	0.21102983
RBAR^2	0.02361085	0.02058362	0.13835349	0.14276119	0.14912304	0.15389679	0.15033982
Durbin-Watson critical values	1.95712055	2.17551391	2.38866340	1.68155337	2.79043578	2.64163396	2.48840029

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	-3973014 (-0.94266034)	-2.074014 (-0.3777748)	-0.5458117E-01 (0.009459874)	-1.348654 (-0.1890791)	-3.395783 (-0.3623969)	-1.242067 (-0.2131412)	-0.1702191 (-0.03084949)
Di	19.86506 (2.107725)	10.370085 (0.8447286)	0.02728945 (0.02115204)	6.743261 (0.04227932)	16.97888 (0.8103423)	6.210294 (0.4765950)	0.8510704 (0.06897954)
R^2	0.22849441	0.04541085	0.00002983	0.01177660	0.04194093	0.01491696	0.00031711
RBAR^2	0.16914783	-0.02801908	-0.02801908	-0.06424059	-0.03175592	-0.06085865	-0.07658157
Durbin-Watson critical values	2.49495939	1.94538841	2.58831307	2.82547023	1.91489431	2.58724935	1.99547424

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	-0.1143511	-0.6495266	-0.3835196	1.108512	2.801674	4.001412	1.115216
	(-0.02329006)	(-0.1583482)	(-0.1015637)	(0.3180704)	(1.499354)	(1.905607)	(0.4507372)
Di	0.2858727	1.948576	1.150556	-3.325541	-8.405027	-12.004223	-5.575511
	(0.04148435)	(0.2817540)	(0.1772707)	(-0.5771400)	(-2.697945)	(-3.396543)	(-1.202135)
R^2	0.01070983	0.01368722	0.00541168	-0.00400157	0.30460783	0.36840879	-0.04835196
RBAR^2	-0.07508172	-0.06218300	-0.07109511	-0.08123245	0.25111612	0.31982485	-0.12899441
Durbin-Watson critical values	1.79083081	2.49901737	1.59128286	2.27499792	1.78762906	2.41089547	2.22075473
DI=1.08 Du=1.36							
Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	-1.9663364	-1.174962	-0.3817957	-0.5851571	-1.401397	-1.280747	-1.622212
	(-0.5064286)	(0.3563854)	(-0.08591632)	(-0.1012746)	(-0.2736115)	(-0.2245921)	(-0.3117935)
Di	9.831818	5.874808	1.908979	2.925785	7.006984	6.403733	8.111363
	(1.132409)	(0.7969019)	(0.1921147)	(0.2264569)	(0.6118139)	(0.5022033)	(0.6972173)
R^2	0.07875703	0.04061723	0.002455450	0.00340720	0.02434686	0.01653584	0.03139018
RBAR^2	0.00789219	-0.03318144	-0.07427977	-0.07325379	-0.05070338	-0.05911525	-0.04311826
Durbin-Watson critical values	2.13692602		1.95572738	2.16943861	2.74614529	1.95737141	1.95265945
(DI=1.08 Du=1.36							
Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	-0.9895636 (-0.1464665)	-2.074274 (-0.2596739)	3.902457 (0.4359032)	2.950118 (0.3813212)	-1.959456 (-0.2687376)	0.1466499 (0.01940490)	2.249976 (0.3292299)
Di	4.947808 (0.4884473)	10.37138 (0.8062055)	-19.51230 (-0.9949163)	-14.75058 (-0.8603049)	14.69593 (1.149351)	-1.099860 (-0.05511016)	-16.87309 (-0.9275029)
R^2	-0.03825104	-0.06534057	0.05552598	0.04009505	-0.05850457	0.00091945	0.03449728
RBAR^2	-0.11811651	-0.14728985	-0.01712587	-0.03374379	-0.13992800	-0.07593290	-0.03449728
Durbin-Watson critical values	1.45852929	1.38356187	2.30517054	1.74443756	2.13673928	2.35236803	2.22963883
DI=1.08 Du=1.36 Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	0.5781549 (0.1457942)	-0.5474533 (-0.09792969)	0.8108339 (0.1810609)	0.1095167 (0.02153979)	-1.616080 (-0.3485983)	-1.925989 (-0.3891493)	-3.900074 (-0.6481799)
Di	-2.168081 (-0.2823293)	2.052950 (0.1896400)	-3.040627 (-0.3506229)	-0.4106877 (-0.04171162)	6.060302 (0.6750578)	7.222459 (0.7535843)	14.62557 (1.255220)
R^2	0.00528590	0.00239182	0.00812914	0.00011598	0.02948446	0.03647825	0.09505421
RBAR^2	-0.07123057	-0.07434727	-0.06816862	-0.07679818	-0.04517059	-0.03763881	0.02544299
Durbin-Watson critical values	1.08725061	1.27574057	1.30748957	1.03700439	1.25824954	0.87227483	1.52997356
DI=1.08 DU=1.36 Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	-2.911898	0.3482651	2.067867	-2568514	-4.295794	-4377787	-7.102780
	(-0.3950410)	(0.05066182)	(0.2890355)	(-0.3390217)	(-0.4983148)	(-0.4554886)	(-0.6401967)
Di	7.279739	-0.8706698	-5.169675	7.705539	12.88739	13.13336	21.30836
	(0.6634495)	(-0.083096)	(-0.4710218)	(0.6136358)	(0.8842710)	(0.8075091)	(1.135652)
R^2	0.00334805	0.00144881	0.02773836	0.01238201	0.07185105	0.04990061	0.06115008
RBAR^2	-0.07331745	-0.07536282	-0.04705100	-0.06358861	0.00045498	-0.02318396	-0.01106915
Durbin-Watson critical values	1.66064210	1.89289134	1.5773	2.27304851	2.38220804	1.98337163	2.33458687
DI=1.08 Du=1.36							
Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freddom 13							
Constant coeff.	0.1867602	0.8179733	1.318636	0.2451795E-02	0.3609941	0.2973562	0.8144393
	(0.03849975)	(0.2090880)	(0.3813822)	(0.5975593E-03)	(0.1075818)	(0.07405083)	(0.3543067)
Di	-2.801403	-12.26960	-19.7795954	-0.03677693	-5.414912	-4.460343	-12.21544
	(0.1491089)	(-0.8097943)	(-1.477087)	(-0.2314337E-02)	(-0.4166624)	(-0.2867976)	(-1.372095)
R^2	0.00148004	0.04188660	0.12698246	0.36E-06	0.01144142	0.00545362	0.11151360
RBAR^2	-0.07532919	-0.03181443	0.05982726	-0.07692269	-0.06460155	-0.07104995	0.04316849
Durbin-Watson critical values	1.69302999	1.25883717	2.21900310	1.31589596	1.76021243	2.45693541	1.62450877
DI=1.08 Du=1.36							
Sign. Level: 5%							

Dependent variable: Yi	EQUATION1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Unsable obs. 15							
Degrees of freedom 13							
Constant coeff.	-0.4860166	-1.473908	0.1795127	1.101266	-0.5535908	-0.07154030	0.9519554
	(-0.1517853)	(-0.4268876)	(0.05934876)	(0.3017728)	(-0.1584619)	(-0.01764992)	(0.2402055)
Di	2.430083	7.369539	-0.8975636	-5.506332	2.767954	0.3577015	-7.138551
	(0.3394367)	(0.9545639)	(-0.1369371)	(-0.6810511)	(0.3597468)	(0.4022397E-01)	(-0.7344557)
R^2	0.00796774	0.05760239	-0.00119116	0.03551676	0.01256798	-0.00044704	0.01578619
RBAR^2	-0.06834243	-0.01488974	-0.07820586	-0.03867426	-0.06338833	-0.07740451	0.05992256
Durbin-Watson critical values	2.2222904	2.76580726	1.64521270	2.77407174	1.96152370	2.46676554	2.00188726
DI=1.08 Du=1.36							
Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	1.995278	1.3693368	1.458478	1.328986	2.227103	3.366120	2.851512
	(0.7644472)	(0.3976920)	(0.5878080)	(0.4163147)	(0.6097780)	(0.8757054)	(0.7852322)
DI	-9.976392	-6.846839	-7.292390	-6.644928	-11.13552	-16.83060	-14.25651
	(-1.709356)	(-0.8892663)	(-1.314379)	(-0.9309080)	(-1.363505)	(-1.958137)	(-1.755703)
R^2	0.16303505	0.05007947	0.10327793	0.05461726	0.11027523	0.20358069	0.17046840
RBAR^2	0.09865313	-0.02299135	0.03429931	-0.1810449	0.04183487	0.14231766	0.10665828
Durbin-Watson critical values	2.22168708	1.07645249	2.48138395	2.31668837	2.19601480	1.88694589	1.94069059
DI=1.08 Du=1.36							
Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	0.3730657	-0.2148949	0.8457920	2.674096	1.651971	-0.2316166	0.9743517
	(0.1043373)	(-0.05975063)	(0.271108)	(0.9075866)	(0.5031544)	(-0.5572658E-01)	(0.3730850)
Di	-1.865328	1.074474	-4.228960	-13.37048	-8.259857	1.158083	-4.871558
	(-0.2333054)	(0.1336065)	(-0.6062089)	(-2.029425)	(-1.125087)	(0.1246084)	(-0.8342092)
R^2	0.00361564	0.00118863	0.02391342	0.21542239	0.07782094	0.00103408	0.04433673
RBAR^2	-0.07302931	-0.07564301	-0.05117017	0.15507027	0.00688409	-0.07580945	-0.2917583
Durbin-Watson critical values	2.02915318	1.67843333	1.62141179	1.57466136	2.35708914	2.51258140	1.73765877
DI=1.08 Du=1.36							
Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	2.120553	3.382453	2.502071	2.448382	2.544901	1.086950	2.243213
	(0.7151298)	(1.050298)	(0.9310012)	(1.186900)	(1.530528)	(0.7264855)	(1.452220)
Di	-10.60277	-16.91226	-12.51035	-12.24191	-12.72451	-5.434750	-11.21588
	(-1.599079)	(-2.348537)	(-2.081782)	(-2.653990)	(-3.422365)	(-1.624471)	(-3.247209)
R^2	0.14564251	0.26884996	0.22415733	0.31953233	0.43846680	0.14960714	0.41278643
RBAR^2	0.07992271	0.21260765	0.16447712	0.26718866	0.39527194	0.08419230	0.36761616
Durbin-Watson critical values	1.77894671	2.51635216	2.17430731	2.06169882	1.22680986	2.21902897	1.90062094
DI=1.08 Du=1.36							
Sign. Level: 5%							

Dependent variable: Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	-0.1800033 (-0.03772072)	-0.2161190 (-0.5925244E-01)	-0.3750179 (-0.07614746)	-0.01731893 (0.002697216)	-0.2464710 (-0.05091359)	-0.6264092 (-0.1580217)	-0.3815093 (-0.1208176)
Di	2.700014)	3.241627 (0.22947.25)	5.625309 (0.2949200)	0.2597499 (0.01044490)	3.697135 (0.1971912)	9.396171 (0.6120176)	5.724009 (0.4680367)
R^2	0.00142079	0.00349823	0.00576509	0.727E-04	0.002585559	0.02436268	0.01439369
RBAR^2	-0.07539299	-0.07345575	-0.07071452	-0.07691524	-0.07413860	-0.5068635	-0.06142218
Durbin-Watson critical values	2.22584964	2.72059745	1.95465505	1.51365163	0.99335601	2.11309732	2.16826465
DI=1.08 Du=1.36 Sign. Level: 5%							

Dependent variable:Yi	EQUATION 1	EQUATION 2	EQUATION 3	EQUATION 4	EQUATION 5	EQUATION 6	EQUATION 7
Total observations 15							
Usable obs. 15							
Degrees of freedom 13							
Constant coeff.	0.1158144 (0.01476685)	-0.7414593 (-0.1517366)	-0.7416329 (-0.1422410)	-0.9615478 (-0.2138293)	-0.1268716 (-0.01410233)	0.02064464 (0.005877799)	-0.1781357 (-0.04111873)
Di	-1.737144 (-0.05718938)	11.12191 (0.5876746)	11.12441 (0.5508931)	14.42328 (0.8281609)	1.903062 (0.05461772)	-0.3096146 (-0.02276058)	2.673946 (0.1593660)
R^2	0.21799E-03	0.02250592	0.01983099	0.04372415	0.19883E-03	3454E-04	0.00169031
RBAR^2	-0.07668831	-0.05268594	-0.05556663	-0.02983554	-0.07670895	0.07688589	-0.07510275
Durbin-Watson critical values	1.06412186	1.39885901	0.88713889	1.69135617	2.92378012	2.59692459	1.391182935
DI=1.08 Du=1.36 Sign. Level: 5%							

EQUATION 1

Model specification	Constant	X_t	X_{t-1}	$\log X_t$	$\log X_{t-1}$	$\log^2 X_t$	$\log^2 X_{t-1}$	Di	R^2	F-stat	D-W
type 1	0.1803 (6.7697)	2.395E-09 (1.9125)						-0.0283 (0.664)	0.0216	1.2697 (F*=3.07)	1.9501 (D_L=1.634 D_U=1.715)
type 2	0.2073 (7.8033)		-9.7E-10 (-0.67)					0.0028 (0.065)	0.00034	0.0191 (F*=3.07)	2.0205 (D_L=1.634 D_U=1.715)
type 3	-1.377 (3.6052)			0.100 (4.1385)				0.0590 (-1.410)	0.068711	4.2423 (F*=3.07)	1.8704 (D_L=1.634 D_U=1.715)
type 4	-16.5292 (-3.182)			1.9825 (3.0916)		-0.0582 (-2.949)		-0.0503 (-1.216)	0.0931	3.9032 (F*=2.68)	1.8334 (D_L=1.613 D_U=1.736)
type 5	1.7489 (0.2902) (0.2902)				-0.1932 (0.2568)		0.00601 (0.2564)	-0.0068 (-0.1583)	0.001743	0.066917 (F*=2.68)	2.0185 (D_L=1.613 D_U=1.736)

EQUATION 2

Model specification	Constant	X_t	X_{t-1}	$\log X_t$	$\log X_{t-1}$	$\log^2 X_t$	$\log^2 X_{t-1}$	Di	R^2	F-stat	D-W
type 1	0.1086	1.392E-09						-0.0462	0.0291	1.7277	2.1158
	(5.0458)	(1.5759)						(-1.339)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 2	0.1197		2.315E-09					-0.0341	0.0097	0.5667	2.1260
	(5.4854)		(0.2288)					(-0.9728)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 3	-0.9359			0.0668				-0.0657	0.0813	5.0936	2.062
	(-3.053)			(3.4569)				(-1.9431)		(F*=3.07)	(D_L=1.634) D_U=1.715)
type 4	-11.85			1.4142		-0.0414		-0.0587	0.1265	5.5056	2.0176
	(-2.915)			(2.8339)		(-2.7123)		(-1.7777)		(F*=2.68)	(D_L=1.613 D_U=1.736)
type 5	3.2985				-0.3897		0.0119	-0.0290	0.0057	0.220	2.1364
	(0.7232)				(-0.6926)		(0.6874)	(-0.8284)		(F*=2.68)	(D_L=1.613 D_U=1.736)

EQUATION 3

Model specification	Constant	X_t	X_{t-1}	$\log X_t$	$\log X_{t-1}$	$\log^2 X_t$	$\log^2 X_{t-1}$	Di	R^2	F-stat	D-W
type 1	0.1314	5.878E-11						0.0156	0.0015	0.0913	1.9983
	(3.9927)	(0.0502)						(0.3020)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 2	0.1505		-1.875E-09					0.0366	-0.0084	0.5013	1.9972
	(4.7283)		(-1.6835)					(0.7102)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 3	-1.1809			0.0822				-0.0268	0.1395	9.3285	1.9796
	(-2.9607)			(3.30)				(-0.5606)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 4	-23.553			2.8226		-0.0836		-0.0331	0.3997	25.306	1.9113
	(-6.849)			(6.6439)		(-6.3768)		(-0.8221)		(F*=2.68)	(D_L=1.613 D_U=1.736)
type 5	28.3251				-3.4315		0.1040	-0.3567	0.0120	0.4662	2.0847
	(0.7453)				(-0.7356)		(0.7280)	(-1.1768)		(F*=2.68)	(D_L=1.613 D_U=1.736)

EQUATION 4

Model specification	Constant	X_t	X_{t-1}	$\log X_t$	$\log X_{t-1}$	$\log^2 X_t$	$\log^2 X_{t-1}$	Di	R^2	F-stat	D-W
type 1	0.0824	8.179E-10						0.0220	0.0045	0.2607	1.7271
	(2.7581)	(0.7733)						(0.631)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 2	0.0972		-3.210E-09					0.0353	0.0071	0.4159	1.6726
	(3.3439)		(-0.3072)					(0.7758)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 3	-0.7755			0.0541				0.0016	0.0266	1.5761	1.8215
	(-1.9979)			(2.2436)				(0.0368)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 4	-8.0329			0.9431		-0.0271		0.0024	0.0331	1.3032	1.8208
	(-1.6143)			(1.5492)		(-1.4601)		(0.0548)		(F*=2.68)	(D_L=1.613 D_U=1.736)
type 5	-0.0257				0.0292		-0.0013	0.0393	0.0111	0.4340	1.6659
	(-0.1114)				(0.7698)		(-0.7715)	(0.862)		(F*=2.68)	(D_L=1.613 D_U=1.736)

EQUATION 5

Model specification	Constant	X_t	X_{t-1}	$\log X_t$	$\log X_{t-1}$	$\log^2 X_t$	$\log^2 X_{t-1}$	Di	R^2	F-stat	D-W
type 1	0.0354	2.084E-10						0.0187	0.0099	0.5751	1.9611
	(1.1162)	(2.1255)						(0.3820)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 2	0.0692		-2.307E-19					0.0490	0.0096	0.5599	1.9446
	(2.1556)		(-0.2054)					(0.9938)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 3	-1.2222			0.0799				-0.0018	0.0095	0.5528	1.9651
	(-2.9437)			(3.1101)				(-0.037)		(F*=3.07)	(D_L=1.634 D_U=1.715)
type 4	-8.2767			0.9516		-0.0268		0.0053	0.0167	0.646	1.9504
	(-1.5322)			(1.4507)		(-1.3507)		(0.1071)		(F*=2.68)	(D_L=1.613 D_U=1.736)
type 5	-0.0402				0.0358		-0.0018	0.0590	0.0230	0.9052	1.9453
	(-0.1645)				(0.8993)		(-0.9878)	(1.2019)		(F*=2.68)	(D_L=1.613 D_U=1.736)

EQUATION 6

Model specification	Constant	X_t	X_{t-1}	$\log X_t$	$\log X_{t-1}$	$\log^2 X_t$	$\log^2 X_{t-1}$	Di	R^2	F-stat	D-W
type 1	0.0320 (0.6984)	3.659E-09 (2.9289)						-0.1517 (2.9289)	0.06577	4.0485 (F^*=3.07)	2.0509 (D_L=1.634 D_U=1.715)
type 2	0.0831 (1.7850)		8.019E-10 (0.5555)					-0.1165 (-1.6174)	0.0245	1.4474 (F^*=3.07)	2.0305 (D_L=1.634 D_U=1.715)
type 3	-2.5681 (-5.2255)			0.1642 (5.4342)				-0.1874 (-2.9362)	0.2217	16.384 (F^*=3.07)	1.9696 (D_L=1.634 D_U=1.715)
type 4	-25.8144 (-5.6590)			3.0118 (5.4058)		-0.0869 (-5.1144)		-0.1595 (-2.8402)	0.3992	25.252 (F^*=2.68)	1.8540 (D_L=1.613 D_U=1.736)
type 5	-0.034 (-0.093)				0.0127 (0.2169)		-0.0002 (-0.11)	-0.1044 (-1.4361)	0.0192	0.7518 (F^*=2.68)	2.0248 (D_L=1.613 D_U=1.736)