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Entry and exit from Greek manufacturing industry: a test of the symmetry hypothesis

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The paper examines the role of trade patterns in the entry and exit decisions of firms and tests the existence of symmetry between entry and exit factors. Trade patterns were found, through their entry and exit impact, to affect the structure of Greek industry rather unfavourably. Prospects seem to be bleaker within the integrated European market of the 1990s. The lack of symmetry leads to increasing concentration. The gloomy outlook is improved by the strong stand of existing, competitive firms.

I Introduction

Firm entry and exit are important determinants of market structure and, consequently, of the growth and welfare of an economy. Therefore, it is interesting to uncover the specific factors that influence these determinants as well as the way that they do so. Such factors are usually classified under two headings: entry (exit) promotion and barriers discouraging movement.

It has been argued in the literature that there exists a symmetrical relationship between entry and exit barriers (Caves and Porter, 1976; Eaton and Lipsey, 1980, 1981). The argument is based on the understanding that every barrier to entry can, simultaneously, be seen as a barrier to exit.

Investment in product-specific assets from machinery to marketing and advertising is thought of as a sunk cost, since it has limited, or no other, value if the specific production for which it has been bought stops. The higher the sunk costs the more effectively entry is deterred. On the other hand, once investments are made, the incentive to leave the sector is reduced and the higher the sunk costs paid out. In the sense of investment specificity, barriers to entry are simultaneously barriers to exit. Other structural barriers, such as concentration, may affect exit in the same way they affect entry. The more concentrated the market the higher the expected collusion and thus the more hesitant are entrants. At the same time firms must feel more protected in a concentrated market and thus feel less willing to leave it.

The purpose of this paper is to test the existence of such a symmetry in Greek manufacturing industry in the 1982–88 period. In addition to the usual barriers and the other entry and exit enhancing factors, the effect of trade patterns on entry and exit will be examined. With the European Market integrated and all the national frontiers abolished from 1/1/93 the effect of import and export penetration on the decision to enter or to leave a sector requires more attention. Does import penetration deter entry or encourage exit? Does export orientation of a sector attract entry and discourage exit? Are these effects significant? If they are, the abolishment of the frontiers with the ease of foreign penetration it brings, will seriously affect the structure of Greek industry.

Before ending the introduction, some descriptive statistics should be disclosed. The entry rate of Greek manufacturing firms in the 1982–88 period is 7.71% and the exit rate is 6.85%, i.e. for every 100 existing firms 7.7 new ones were entering, while 6.9 old ones were leaving their sectors. The correlation between the two rates is 0.25, while the correlation between the numbers of entering and exiting firms is 0.72. Entry and exit are highly correlated, as expected, since they are both affected by the same factors.

The paper includes three more sections. Section II describes the model and the variables to be used, Section III presents the regression results and Section IV draws the conclusions.

II Model and data

Entry, *EN*, is usually modelled as a function of the difference between expected, Π, and entry forestalling profits, Π^* (Orr, 1974; Geroski, 1991a). The entry forestalling profits depend on the height of the entry barriers which incumbent firms can erect against new competitors. Thus, Π^* depends in turn on capital requirements and barriers, such as excess capacity (Hilke, 1984; Lieberman, 1987), advertising and R&D expenses (Kessides, 1986, 1991), the degree of concentration (Schwalbach, 1991) the business or market risk (Schwalbach, 1987) etc. Other factors such as labour market characteristics (Storey and Jones, 1987; Shapiro and Khemani, 1987), expected growth and size of a sector (Baldwin and Gorecki, 1987; Acs and Audretsch, 1989), the extent of multi-plant operations (Duetsch, 1984a), the nationality of entrants (Geroski, 1991b) and incumbents (Khemani and Shapiro, 1986) have been found to be significant determinants of entry.

$$EN = A_1(\Pi - \Pi^*) + \epsilon \tag{1}$$

where ϵ includes all other variables affecting entry and

$$\Pi^* = \beta_0 + \beta_1 KR + \beta_2 AD + \beta_3 CR + \beta_4 BR \tag{2}$$

By substituting (2) into (1) and specifying some of the factors known to be included in ϵ

$$EN = \gamma_0 + a_1\Pi - \gamma_1 KR - \gamma_2 AD - \gamma_3 CR - \gamma_4 BR + \gamma_5 SI$$
$$+ \gamma_6 GR + \gamma_7 LA + \gamma_8 IMP + \gamma_8 EP + e_1 \quad (3)$$

where e_1 includes all unknown factors, KR is capital requirements, AD is advertising expenses, CR is the degree of concentration, BR is business risk, SI is size, GR is the growth rate, LA is the relative cost of labour, IMP and EP are import and export penetration respectively.

Exit, EX, is less well studied in theory and practice (Macdonald, 1986; Mayer and Chappel, 1992). Following the work of Dunne *et al.* (1988), Badden-Fuller (1989), Londgran (1990), Lieberman (1990), Schary (1991), Baldwin and Corecki (1991), exit depends negatively on expected profits, industry size, barriers to exit erected by sunk costs, and all other barriers and variables affecting entry according to the symmetry hypothesis as examined by Shapiro and Khemani (1987) and Duetsch (1984b), Thus

$$EX = \delta_0 + a_2\Pi - \delta_1 KR - \delta_2 AD - \delta_3 CR - \delta_4 BR + \delta_5 SI$$
$$+ \delta 6 GR + \delta_7 LA + \delta_8 IMP + \delta_9 EP + e_2 \qquad (4)$$

where e_2 includes all unknown factors affecting exit.

In order to estimate (3) and (4) annual data referring to gross entry and exit numbers from the 20 2-digit Greek manufacturing sectors during the 1982–88 period were used[1]. Such data are found in the annual surveys of Greek industry published by the Statistical Service of the Confederation of Greek Industries (CGI) and refer to large-size firms[2]. 120 observations were available. Information on the independent variables was obtained either from the same source (Π, KR, BR, SI) or special editions of the Greek National Statistical Service (AD, CR, GR, LA). Finally, data on EP and IMP were acquired from the former source and the Bank of Greece respectively.

More specifically, EN, is the ratio of the number of entrants over the number of existing firms, while EX is the respective ratio of exiters. Π is expected profits formulated according to lagged expectations[3]. Other

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[1] Information on entry and exit is available only at the 2-digit level for Greek manufacturing industry. Most papers on entry use 3- or 4-digit data, which provide better information. Using such aggregate data hides part of intra-industry differences, which could be important and so provide less sensitive results.

[2] The Statistical Service of the CGI collects its data from the balance sheets of corporations. It includes up to 3500 firms annual accounting for about 90% of total assets in Greek manufacturing industry. The firms taken into account are large and the information available on entry refers to absolute numbers and total assets. Unfortunately, information on exit refers only to numbers. Thus, no size proxy for exiting firms was available for our estimations. Therefore only the numbers of entering and exiting firms were used.

[3] Expected profits in the entry equation are proxied by the ratio of average gross profits of each sector over average gross profits of the manufacturing industry, both lagged by one year. Expected profits in the exit equation are proxied by the log of gross profits lagged by one year. Other types of expectations, such as adaptive, static and rational with perfect fore-sight, were used but they gave inferior results.

forms of expectations were used but they produced inferior results. Data on capital are not available[4], thus productivity was used as a proxy for *KR*, in the sense that productivity is positively and closely associated with capital endowments. Productivity is the ratio of value added in each sector to the number of respective employees.

AD is the ratio of advertising expenses over sales and *CR* is the four largest firms concentration ratio in terms of employment, *BR* is the standard deviation of profitability in the last four years divided by the average profitability in the same period. Profitability is the ratio of gross profits to total (own and borrowed) capital. *SI* is the share of production value of each sector over the industry total and *GR* is the annual growth rate of employment. The growth rate of total assets, as well as the growth rate of sales, were used but they were not found to be significant. Such growth rates may also suffer from inflation problems, which is not the case with employment. *LA* is the ratio of the average wages in each sector over the average wage of industry. *IMP* is the ratio of each sector's imports over relevant domestic demand as estimated by the Bank of Greece and *EP* is the value of exports over sales.

III Empirical findings

1 Entry regressions

As can be seen from Table 1 only eight of the ten independent variables are reported in the estimations. Two, namely capital requirements and business risk are not included because they were insignificant in all cases. The best fit was achieved by the semi-log specification versus the linear one, judging by Sargan's criterion which was 1.39 and 1.42 for the entry and the exit equation respectively[5].

In the first two columns are the regression results for the whole period 1982–88. In 1985 an austerity programme was introduced by the government which affected Greek firms. Thus, in order to test the stability of the coefficients before and after the austerity programme the equations are estimated separately for the 1982–85 and 1986–88 periods. The results are presented in the last four columns and a Chow test is performed which

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[4] Data on capital collected and published by the CGI are taken from the balance sheets of corporations and refer to capital at historic cost, i.e. at the price of its acquisition. They cannot be transferred to constant prices and therefore, they cannot be used in any econometric analysis.

[5] Sargan (1964) has suggested a maximum likelihood ratio test for choosing between alternative functional forms. The standard errors of the alternative forms must be compared and the one giving the relatively smaller error must be chosen. In order to compare the standard errors of a linear (*SE*) and a log (*se*) form, they should be expressed in comparable units. Therefore, *se* is multiplied with the geometric mean of the dependent variable (*gm*). If the ratio *SE/se.gm* is less than one, the linear version is preferred and vice versa.

Table 1   Entry and exit from Greek manufacturing industry 1982–88

	1982–88		1982–85		1986–88	
	EN	EX	EN	EX	EN	EX
C	-0.98	1.21	-1.44	1.18	-1.51	1.17
	(1.21)	(2.61)	(1.16)	(2.04)	(1.05)	(1.41)
CN	-1.50	-0.31	-1.60	-0.47	-1.23	0.09
	(2.96)	(0.59)	(1.99)	(0.65)	(1.72)	(0.11)
IM	-0.62	-1.06	-0.76	-1.41	0.23	-0.70
	(1.89)	(3.43)	(1.52)	(3.55)	(0.46)	(1.33)
EP	1.37	2.25	1.29	2.15	0.40	1.70
	(1.86)	(3.05)	(1.33)	(2.47)	(0.28)	(1.14)
AD	-12.19	9.68	-7.89	15.89	-22.73	-1.78
	(1.33)	(1.16)	(0.61)	(1.47)	(1.51)	(0.12)
WA	-2.84	0.68	-2.64	0.66	-3.26	0.85
	(5.13)	(1.42)	(3.00)	(1.04)	(4.21)	(1.05)
VA	-6.01	9.39	-6.01	9.75	-6.01	9.89
	(2.70)	(5.02)	(1.80)	(4.13)	(1.71)	(2.98)
GR	1.48	3.02	-0.45	1.16	2.91	2.85
	(1.16)	(2.42)	(0.19)	(0.56)	(1.74)	(1.58)
Π	0.72	-0.32	0.75	-0.30	0.81	-0.35
	(6.96)	(7.95)	(4.46)	(6.25)	(4.65)	(4.55)
R^2	0.58	0.57	0.52	0.61	0.58	0.49
F	21.26	21.37	10.34	14.45	9.52	6.84
N	119	120	69	70	50	50

* *t*-values are reported in parentheses; coefficients with *t*-values > 2.35 are significant at 1%, >1.65 at 5% and > 1.30 at 10% (one-tail test).

supports the stability of the coefficients despite the turbulent environment of the mid-80s.

The explanatory ability of the model is satisfactory at explaining 58% and 57% of the variation of the changes in the entry and exit ratios respectively—a high score for such a pooled sample which compares favourably with results from relevant studies. Multicollinearity and heteroscedasticity tests were performed. Neither seemed to create any problems. The Goldfeld and Quandt test for heteroscedasticity (Judge *et al.* 1988) resulted in F ratios that were 1.60 for the entry and 1.45 for the exit equation, both less than the critical values of F with 40 DOF at 5% and 1% which are 1.69 and 2.11 respectively[6].

Expected profits and growth were found to affect entry positively although not significantly in the case of growth. The size of the market affected entry negatively, which is the opposite of what was expected. It

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[6] Shapiro and Khemani (1987) found a high correlation between the errors of the entry and exit equations and consequently they used a full information maximum likelihood method of estimation. In our case the correlation between e_1 and e_2 was only 0.20. Thus, it was not considered necessary to use a more complicated method than OLS. Data requirements would also be impossible to meet in any alternative case.

seems that the larger the market the less willing firms are to enter, probably because they consider it saturated.

The relative wage of the sector, which is a proxy for the relative labour cost, influences entry negatively. This means that entrants are not willing to try their luck in labour expensive productions. Advertising expenses are a barrier to entry but not a very significant one. They are probably seen as a sunk cost which new firms are not willing to bear. The degree of concentration also plays a very important negative role. Apparently, high concentration is thought of as an indication of possible collusion and predatory behaviour against entrants, increasing the uncertainty of their success.

The two new variables concerning the effect of import penetration and export share in sales of each sector also play a significant role. Entry is encouraged by an increasing export share, while it is discouraged by increasing import penetration. This result is very important for the development of Greek industry in view of the abolishment of national frontiers within the EU and the ease of capital mobility it brings. Sectors facing increasing import penetration will be abandoned by prospective entrants, which means that production will be limited to the existing Greek firms and (possibly) many foreign ones. Thus, Greek manufacturing production might eventually shrink, at least in the highly import penetrated sectors.

At the same time, the positive sign of the export share means that entry is directed towards sectors with export potential. Such sectors in Greece are mainly food and beverages, textiles, clothing and footwear, leather and fur. On the contrary, the import penetrated ones are high-tech goods, electronics, machinery, cars and medical equipment.

The estimated trade effects suggest that specialization of manufacturing production towards export oriented sectors and away from import penetrated ones will be increased following the integration of the Greek economy into the European market. Specialization may be a good prospect if it is accompanied by an increase in trade. It may be a bad one if it means that production will be restricted to few light, consumer oriented goods with low technological input (competitive only because of the lower labour cost) which are currently the main exported goods of Greece. In this case, specialization means increased trade benefits for the short run, but possibly serious structural problems for the long run when such goods will be more inexpensively imported in the EU by the NICs and other cheap labour countries.

2 Exit regressions

The picture is improved if the effects of the same variables on exit are considered. The signs are the same, namely positive for exports and negative

for imports, which means that exit is increasing with export potential and decreasing with import penetration. One explanation may be that since many firms try entry in export intensive sectors, many fail to survive and close down or exit in time. Probably only the efficient and internationally competitive ones survive at the end.

Exit is also decreasing with increasing import penetration, which means that firms established in such a highly competitive environment and specialized in certain product niches, apparently not satisfied by imports, do not exit easily. Actually, the more penetrated the sector the less firms exit, which means that existing firms occupy a solid position in their markets. This result improves the picture drawn according to the entry results, since it means that incumbent firms are not suffering so much from increasing European integration except if they are inefficient to compete internationally.

It seems that the effect of an increasingly international competitive environment is not as negative as the entry equation shows. After all, exit may balance the specialization bias which will be enhanced by entry decisions within a free European market.

Exit is influenced negatively by expected profits, i.e. the higher the expected profits the less reasons there are for exit. The positive sign of growth and size comes as a surprise. The explanation of the size effect may be that exit is higher in larger sectors, which agrees with Shapiro and Khemani (1987). The positive growth effect is difficult to interpret but it may mean that, as with size, movement is higher in high growth sectors. Also, since growth refers to employment, it may mean that exit is encouraged by increasing labour requirements. Large and high growth sectors host a lot of movement and finally displacement.

Relative wage affects exit positively although not very significantly. It is not unreasonable for exit to be encouraged by high labour costs. Finally, concentration and advertisement are not exercising any significant effect on the exit decision.

Because of the 1985 austerity programme, it was decided to test for the stability of the coefficients between the pre- and the post-austerity periods. A Chow test was performed which rejected the non-stability hypothesis. The resulting F ratios were 0.73 and 0.38 for the exit and the entry regressions respectively, both lower than the critical value of F with 9 and 102 DOF at the 5% and 1%, which are 2.00 and 2.62 respectively.

The only striking difference in the coefficients between the two periods refers to the import and export variables, which are insignificant for the 1986–88 period, probably because both imports and exports were seriously reduced, thus not affecting so much entry and exit decisions. Also, the growth effect on entry was strengthened in the 1986–88 period showing a preference for perspectives since current affairs were not flourishing.

In view of these results, symmetry does not seem to hold for the Greek

case[7], at least not unequivocally. Most coefficients come up with opposite signs, except concentration which is not significant for exit. The trade patterns solely affect both entry and exit in the same way and thus are the only ones to support a weak symmetry hypothesis.

Why is symmetry weak, one is tempted to ask. It seems to be the case that the usual entry barriers, such as capital requirements, advertising expenses and risk are not really significant for Greek firms in either the entry or exit decision. Thus, there is a symmetry in non-significance, one may notice, arising probably from easy bank borrowing and reduced personal commitment pestering Greek firms. Such factors are often accused for frequent business failures in Green manufacturing industry.

It may also be the case that concentration is an entry deterrent but does not provide any further protection to existing firms and, especially, to the ones established in the market fringe. Thus, it does not affect exit. Also, the relative labour cost may discourage entry, but once a firm is established in a profitable market it is not encouraged to exit because of it.

IV Conclusions

Entry and exit of firms are both very important for the structure of markets. Thus, the factors influencing them deserve close attention. Such factors are usually classified into movement enhancing ones and barriers. Symmetry of their effects on entry and exit is often claimed to be present.

Two hypotheses were tested in the paper: (i) the significance of trade patterns for entry and exit, which is examined for the first time to our knowledge; and (ii) the symmetry of the factors causing firm movement in and out of industry. Greek manufacturing industry in 1982–88 provided the sample.

Import penetration and the share of exports in sales were found to be very significant determinants of both entry and exit. Such an effect will be enhanced by the integrated market of the European Union, which officially started on 1/1/93 and may result in a specialization of manufacturing production not favourable for the Greek economy. The negative impact of trade patterns on entry seems to be impaired by the respective effects of exit, which are encouraging.

Symmetry between entry and exit causing factors does not seem to hold for the Greek manufacturing industry. With the exception of import penetration, which discourages entry and exit and export share, which encourages both of them, the other determinants either do not affect firm movement at all or, if they do, it is in opposite ways. Consequently, factors

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[7] It should be noticed that even in the other studies where entry and exit equations are estimated (MacDonald, 1986; Shapiro and Khemani, 1987; Mayer and Chappel, 1992) the symmetry effects are rather weak and the symmetry hypothesis receives only 'qualified' support.

discouraging entry and promoting exit cause heavier concentration than otherwise.

The implications of the paper, according to the evidence collected and the model used, is that the factors affecting entry and exit in Greek manufacturing industry may result in heavier concentration and foreign domination within the enlarged and integrated European market of the late 1990s. Only the resistance of existing competitive firms seems able to reduce such a threat.

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