# THE DETERMINANTS AND INTERDEPENDENCE OF ENTRY AND EXIT

by

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**Abstract**

Entry and exit play a crucial role in microeconomic models of market structure and performance. This paper reviews empirical studies of the determinants and interdependence of entry and exit. It summarizes and compares a broad range of empirical results for different countries based on industry-specific and firm-specific factors. It also discusses the entry-exit process from an industry life cycle point of view. Furthermore, the interdependence of entry and exit is analyzed.

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**Table of content**

## 1. Introduction

Critical issues in industrial organization, such as competition and efficiency are often studied by looking at the determinants of the inflow and outflow of firms. The entry and exit of firms is an outcome of a market selection process which leads to the restructuring and evolution of industry. New entrants bring new products and technologies into the industry and provide a source of industry expansion and market competition. Alternatively, firms' exit discontinues old products and inefficient technologies and provides opportunities for other firms to enter the market. There are numerous papers which investigate the reasons behind entry and exit. This largely empirical literature has contributed to a better understanding of the determinants of the inflows and outflows of firms. This paper reviews the empirical evidence on the determinants and interdependence of entry and exit.

For a long time, the determinants of entry and exit were studied separately. A large portion of the literature focuses solely on entry (see Orr, 1974; Acs and Audretsch, 1989; Geroski, 1995) while a few works focus on exit (Caves and Porter, 1976; Doi, 1999). Nevertheless, many studies suggest that the determinants of the exit process can be catalogued in much the same fashion as those for entry. The relationship between entry and exit is the focus of a series of studies as well, such as Shapiro and Khemani (1987), Dunne and Robterts (1991), Lay (2003), and Nyström (2005). One common finding of these studies is that there is a strong positive correlation between entry and exit. Therefore, when studying the determinants of

entry and exit, rather than being treated independently, they are better viewed as outcomes of a single economic process of industry or market development.

The paper is structured as follows. The next section discusses industry-specific factors which affect the entry-exit process. The third section demonstrates how firm-specific factors affect entry and exit. Then, a series of studies of entry-exit over the industry life cycle will be discussed. Section five develops the interdependence of entry and exit. The last section concludes the paper.

## 2. Industry-specific factors

Before analyzing the determinants of entry and exit, some measures of entry and exit should be defined. In most empirical studies, the entry rate for industry i in year t is usually defined as the number of firms in operation in the industry in year t that was not in operation in year t-1, divided by the total number of firms in operation in the industry in year t-1. The exit rate in year t is defined as the number of firms in operation in the industry in year t that is no longer in operation in year t+1 divided by the total number of firms in operation in the industry in year t-1. Another measure which may be used is net entry simply, defined as the entry rate minus exit rate.

Heterogeneity is apparent in the entry and exit process across industries. Dunne et al. (1988) summarize the pattern of firm entry, growth, and exit in the four-digit U.S. manufacturing industries over the period 1963-1982. They examine the relative importance of different types of entrants, the persistence of industry entry and exit over time and the correlation between industry entry and exit rates across industries

over time. Their results suggest that there are substantial and persistent differences in entry and exit rates across industries. They further conclude that industry-specific factors which persist over time affecting both entry and exit play an important role in determining entry and exit patterns. Nyström (2005) finds both entry and exit rates to be higher in the service sector than in the manufacturing industry.

Although cross-sectional differences are important, empirical studies have concluded that variations in entry-exit between industries do not persist for very long. Geroski (1995) argues that most of the total variation in entry across industries and over time is within industry rather than between industries.

### 2.1 Current Opportunities

Entry is a response to perceived current opportunities by potential entrants; exit is induced by expected losses and provides a release of productive resources for alternative uses. According to traditional views, incentives to enter, like high profitability and strong market growth, are also disincentives to exit. Most studies incorporate the effects of profitability and growth in determining entry and exit, but the empirical results are mixed.

The inter-industry analysis of entry (and more recently exit) has largely relied upon an ad hoc formulation dating back to Orr (1974a), although the precise specification has varied,[1] To illustrate the impact of current opportunities (proxied by profitability and growth) on entry-exit more clearly, we consider an Orr-type model as

[1] See Shapiro and Khemani (1987), Cable and Schwalbach (1991), Geroski (1991), Mata (1993) and Fotopoulos and Spence (1999).

follows:

Entry = f (Profit, Growth, Entry barrier) (1)

Since most entry barriers deter exit, we could reasonably create an exit model in the same way as follows

Exit = g (Profit, Growth, Entry barrier) (2)

### 2.1.1 Profitability

Orr (1974a) conducted his study on the determinants of entry in Canadian manufacturing industries. He estimated a model which expressed entry as a function of various incentives to enter and barriers to entry. In the literature, profitability is proxied by lagged profitability (past profit rate). He confirmed that the past profit rate had a positive effect on entry as theoretically assumed. But he also pointed out the impact of past profit on entry was weak. Orr (1974b) provided some insights as to why a strong positive relationship between entry and profit rates could hardly be detected in empirical studies: 1) the measure of past profit rate may involve the omission of intangible capital created by advertising or research and development; and 2) limit pricing. Limit pricing theory originated with Bain (1956), Modigliani (1958), and Sylos-Labini (1962) and focuses on the incumbent's behavior to make entry unprofitable to the new entrant. However, due to the development of game theory, a simple limit pricing strategy is rejected as an optimal strategy of the incumbent, as it does not satisfy subgame perfection. Empirical evidence further

suggests that a price strategy is not usually used by incumbents to deter entry (Geroski, 1995).

The weak positive impact of profitability on entry is also reported by a few recent papers. Ilmakunnas and Topi (1999) study the entry-exit process in the Finnish manufacturing industry using a six year panel data set. They found the effect of profitability on entry to be insignificant. A similar result is found in Lay (2003) who studies entry and exit in Taiwan's manufacturing industries from 1987 to 1998.

However, a large number of empirical works found evidence to support a positive and significant effect of profitability on entry. Carree and Thurik (1996) study the determinants of entry and exit using panel data for 23 Dutch shoptypes for the 1981-1988 period. Their results support the positive and significant effect of profitability on entry. Similar results are found in Fotopolous and Spence (1998) using Greek manufacturing industries data from 1982 to 1988, and Kaya and Üçdoğruk (2002) who study the determinants of entry and exit in Turkish manufacturing industries between 1981 and 1997.

A few points can be made about the relationship between profitability and entry: 1) differences in results may come from different measurements: papers which confirm profitability as a strong incentive to entry use price-cost margins to measure profitability instead of the lagged profit rate; 2) limit pricing undermines the effect of profitability as an incentive to entry; and 3) in most cases, if potential entrants perceive the profitability and think that they are able to duplicate pre-entry profits, profitability functions as a significant entry-inducing determinant.

Turning to the exit process, conventional wisdom views exit as taking place when super-normal profits are negative. Logically we should expect the relation between profitability and exit to be negative. However, empirical studies provide inconclusive results on the sign and significance of this relationship.

Dunne and Roberts (1991) use a panel data set for the U.S. manufacturing industries to identify some industry characteristics that are highly correlated with entry and exit, and to assess their importance. In particular, they report that price-cost margins are positively correlated with both entry and exit, and the same sign was found in Rosenhaum and Lamort (1992) and Fotopoulos and Spence (1998). Somehow different results come from Anagnostaki and Louri (1995) who report that average industry profits are positively related to entry but not to exit rates. The reasons for this surprising result are partially answered by Geroski (1995). He proposes that entry and exit may be parts of an evolutionary process where a large number of new entrants displace a large number of existing firms without adding a great deal to the number of competing firms in the short run. When high profits attract entrants, the incumbents with high production costs could be driven to exit by competition. Displacement, as one type of interdependence of entry and exit, will be discussed in the following section.

Conventional wisdom about profitability acting as a disincentive to exit is confirmed in many other studies. That is, higher profits reduce exit, while lower profits stimulate the decision to exit. Doi (1999) who studied the determinants of exit in Japanese Manufacturing industry, found both the price-cost margin and industry

growth to be negatively and significantly related to exit. In other words, lower rates of profits and demand growth encourage exit. His findings are consistent with Carree and Thurik (1996), Kaya and Üçdoğruk (2002), Lay (2003) and Roberts and Thompson (2003).

### 2.1.2 Growth

Unlike profitability, most empirical studies find a significant positive effect of growth on entry. The encouraging role of growth on entry seems intuitive. During periods of fast demand growth, entrants are attracted by increases in profitability due to the inability of incumbents to expand their capacity fast enough. Kessides (1991) introduces a model which enables him to test many hypotheses related to the determinants of entry. One of his hypotheses explains why growth in demand is such a strong incentive to entry. He stated the hypothesis as "Growth in demand for the industry's product exerts a positive influence on entry, because it implies that any additional output supplied to the market will depress price at a slower rate and that the number of firms operating within the industry can increase without lowering the profits accruing to each such firm."(p.31).This hypothesis is strongly supported by his results. Although the positive impact of growth on entry rates is confirmed by most studies (Kaya and Üçdoğruk, 2002; Hölzl and Sögner, 2004), exceptions still exist. Roberts and Thompson (2003) report a positive but insignificant growth effect in the entry equation in Polish manufacturing industry in a transition economy. The special transition economy environment of Poland could possibly explain the exception.

A methodological breakthrough in the studies of current opportunities on the entry-exit process was made by Carree and Thurik (1999) who evaluate the effect of profitability and growth on the entry-exit process together instead of treating them separately. They proposed a new and more uniform approach to the study of entry and exit. Entry and exit are considered to be reactions to (the lack of) profit opportunities. The central concept of this paper is carrying capacity, which is defined as the number of firms such that there is no incentive for net entry (entry minus exit) at the critical level of profits. It is the maximum number of firms which can be sustained by the market. When the actual number of firms in an industry is below the carrying capacity, an increase in net entry occurs, through either an increase in entry or a decrease in the exit. Obviously, changes in consumer demand growth are an important determinant of changes in carrying capacity. By testing the theoretical model on a panel data set of 22 Dutch retail industries for the 1981-1988 period, they conclude that the roles of industry profitability and growth appear to play a more important role on average for entry decisions than for exit decisions, which is consist with MacDonald (1986).

Ilmakunnas and Topi (1999)'s study looks at the Finnish manufacturing industry. By taking the macroeconomic environment and financial system into consideration, they found industry growth and profitability had a much stronger negative impact on exit than the positive impact on entry. The explanation they gave is that opportunities to get outside financing are more important to entry than prospects of internal funding. In other words, internal funding which comes from firms' profits has a much greater impact on exit than on entry.

Some papers suggest the entry-exit process responds not only to domestic demand, but also to foreign demand. This is especially obvious in a small open economy. Sleuwaegen and Dehandschutter (1991) found entry in Belgian industries is largely explained by favorable international profit and growth prospects, while exit results from declining profitability and growth. A similar result is found in Kleijweg and Clever (1996) who use export share to interpret the international effect on entry-exit in Dutch manufacturing industries.

Generally speaking, profitability and industry growth as proxies for current opportunities are a significant incentive to entry and a disincentive to exit. However, growth appears to be a stronger and more reliable factor inducing entry than profitability. Because of the existence of entry barriers and limit pricing, an industry could experience high profit without attracting mass entry. Meanwhile, the positive effect of profitability on exit reported in a few studies may result from a displacement effect.

**2.2 Entry barriers**

According to neoclassical analysis, in the absence of market imperfections, entry and exit ensure that industry supply will converge to a socially optimal level, leaving no excess profits. With this theoretical framework, it is precisely excess profits that attract new entry, while insufficient profitability drives firms out of an industry. However, this supply adjustment process does not always happen as smoothly as theory suggests. A large literature has emerged on the many structural or corporate

strategic factors that retard, impede or even completely block entry. Comparing and summarizing the results of many empirical studies, mostly focusing on the industries in the U.K. and U.S. from 1960 to 1990, Geroski (1995) suggests that entry barriers are high based on econometric estimation. Likewise, it has been found that many entry-impeding factors, like advertising intensity and concentration, also act as barriers to exit.

There has been a long-standing interest in analyzing entry barriers. Bain (1956) analyzed the character and significance of "the condition of entry" by examining 20 U.S. manufacturing industries. He introduced the concept of the condition of entry as a continuous variable, which enables incumbents to raise price above a competitive level without attracting new entry. The determinants of the condition of entry are grouped into three categories: absolute cost advantage of established firms; production differentiation advantages of established firms; and economies of scale. Firstly, absolute cost advantages refer to the situation where the potential entrant's unit cost of production is higher than the incumbent's, because the entrant may suffer from either using inferior production techniques or paying higher prices for productive factors such as labor, materials and money capital. Secondly, product differentiation deters entry because buyers may have a preference for established products as compared to new-entrant products. Thirdly, economies of scale are reflected in a decline of the production and distribution costs per unit of output. The smallest scale at which a firm may achieve the lowest attainable unit cost is considered as the minimum optimal scale. In industries where the minimum optimal

scale is very large, entrants may anticipate either higher than minimum attainable costs or a lower selling price than the current price industry before entry. According to his study, these three factors are considered as the most significant entry barriers.

Orr (1974a) constructs and estimates a model which assumes entry as a function of the incentive to enter relative to the level of entry barriers by using cross-sectional Canadian manufacturing data from 1963-1967. Factors included as entry barriers are the minimum efficient size (MES), capital requirements, advertising intensity, research and development (R&D) intensity and concentration. Based on the results, he concluded that capital requirements, advertising intensity, and high concentration are significant barriers to entry, while R&D intensity is a modest barrier to entry.

A similar study of the determinants of entry in U.S. manufacturing industries between 1963 and 1972 is Duetsch (1984). The methodology and candidates of determinants of entry are borrowed from Orr (1974a) with certain modifications. This paper, for one thing, confirms the performance of the Orr-type entry model, and also reports significantly similar results with Orr (1974a). Thereafter, the Orr-type model was widely applied in the study of the determinants of entry (exit), as well as the choice of explanatory variables in the entry equation. These two papers play a benchmark role in studies of determinants of entry (exit).

Meanwhile, numerous studies focus on another important issue: the relationship between entry barriers and exit barriers. Barriers to entry are found to be barriers to exit and vice versa. There are generally two arguments with respect to this issue: the sunk cost theory and the symmetry hypothesis.

Caves and Porter (1976) suggest that the durability and specificity of a firm's capital will lead to some of that capital investment becoming a sunk cost. Capital specificity is considered as a source of sunk costs, because once capital takes a specific form, it may be costly to transfer it to another use. Capital durability is also a source of sunk cost, because once a firm commits resources to a particular form, if it is not possible to resell capital, the firm must operate until the end of the capitals' life to recover its value. These sunk costs are barriers to exit as well as barriers to entry.

Sunk costs in turn create barriers to entry because sunk costs impose both an asymmetry in the marginal cost and risk faced by an entrant and an incumbent. For the entrants, the act of entry requires the conversion of liquid assets into frozen physical capital, only part of which is recoverable through disinvestment. For the incumbent, however, these commitments have already been made.

The sunk cost characteristic of the assets also represents a barrier to exit for incumbents since the committed assets represent non-recoverable costs. Incumbents are therefore bound to their markets by the inability to disinvest. Caves and Porter (1976) are explicit about the extent to which symmetry may exist: "Each source of entry barriers identified by Bain can also erect a barrier to exit by going firms."(p.44). It is in this sense that sunk costs constitute exit barriers as well. Dunne and Roberts (1991) found empirical evidence to support sunk cost theory by investigating U.S. inter-industry variation in both entry and exit rates. He found that the high inter-industry correlation between entry and exit implies that industries can be characterized by whether they are relatively high entry and exit or low entry and exit

industries. This finding complements the view that a major source of barriers to entry into an industry is barriers to exit.

As an extension of sunk cost theory, the symmetry hypothesis emerges directly from the sunk cost argument in Caves and Porter (1976) and Eaton and Lipsey (1980). The symmetry hypothesis states that there is a symmetrical relationship between entry and exit barriers. Caves and Porter (1976) argued that barriers to entry are also barriers to exit if there is a degree of "sunkness" in costs and other commitments related to the development of protection against potential entry firms in an industry. Shapiro and Khemani (1987) also offer empirical support to Caves and Porter in this respect.

The following section discusses and compares the empirical results of the impact of each entry barrier on entry and exit.

### 2.2.1 Economies of scale

*A) On the entry side*

The effect of economies of scale on entry is often measured by the minimum efficient scale (MES). A large MES makes entry more difficult, because for a given level of demand, it reduces the number of firms that can make positive profits, with each of them producing at the MES.

Empirical studies support the MES as an entry barrier. In Hölzl and Sögner (2004), the growth rate of MES is used to proxy changes of scale economies. Results show that the entry rate will decrease as the MES increases. Combined with the

previous theory of carrying capacity[2] (Carree and Thurik, 1998), they suggested a higher MES reduces the carrying capacity of the industry and therefore impedes entry. A negative and statistically significant influence of MES on entry is also found in Ilmakunnas and Topi (1999). This finding is expected, considering the small size market in Finland where most of entrants are restrained by industry size. Lay (2003) finds opposite results for Taiwan, a country of comparable size to Finland. Since the majority of Taiwan's entrants are fringe producers, the positive coefficient of MES in the entry equation reveals that when the dominant plant is bigger it may provide room for small entrants to compete on the fringe and therefore attract entry.

*B) On the exit side*

As to the impact of economies of scale on exit, the results are more complicated. Conventional wisdom is that economies of scale, as a barrier to entry, also act as deterrent to exit. Shapiro and Khemani (1987) found the commonly cited entry barriers, including MES, are also barriers to exit. One possible explanation could be that in industries with larger MES, entry may be difficult and therefore displacement may not occur. The negative effect of economies of scale on exit has been confirmed by a number of studies (Ilmakunnas and Topi, 1999; Fotopolous and Spence, 1998; Lay, 2003)

In contrast, economies of scale are found to encourage exit in other studies. Aduretsch (1995) suggest that as MES increases, the firms must grow in order to maximize efficiency. The firms which fail to grow fast enough to match MES become

[2] Carrying capacity is defined as the number of firms such that there is no incentive for net entry, see page 8.

inefficient and are forced to exit. Thus the likelihood of survival should be negatively related to scale economies. Similarly, Hölzl and Sögner (2004) report a positive relationship between MES and exit in the study of Austrian manufacturing industries of the period 1981-1988.

An interesting theory compatible with both views was proposed by Doi (1999). By using Japanese manufacturing industries data over the period 1981-1989, he presents evidence that MES has a quadratic, not linear, relationship to the exit rate. He points the inverted-U-shape pattern of MES influence on exit. The MES has an exit-promoting effect until a critical size, beyond which the exit rate tends to decrease as MES continues growing. However, in industries with the largest MES size, there may be a small number of sub-optimal firms which are inefficient producers. Therefore, MES is negatively related to exit. Moreover, in most industries the great majority of firms are suboptimal. Those firms can continue to operate by offsetting disadvantages of small size with alternative advantages. In such way, the exit rate may be reduced.

### 2.2.2 Advertising intensity

*A) On the entry side*

Conventionally, advertising is considered as a barrier to entry. It creates barriers to entry because (1) it requires new entrants to advertise more than incumbents to overcome consumer inertia (or brand loyalty); and (2) a high advertising intensity is

usually expected to create a disadvantage for potential entrants due to the sunk costs that they involve.

The most commonly used measure to evaluate advertising intensity is the advertising expenditure to sales ratio. The impeding impact of advertising on entry is confirmed in numerous studies (Orr, 1974, Shapiro and Khemani, 1987; Acs and Audretsch, 1989; Fotopoulos and Spence, 1998). Moreover, Driffield (1999) reports that advertising deters both domestic and foreign entry in the UK.

On the other hand, the negative relationship between advertising and entry could not be confirmed by some other studies. Macdonald (1986) found no evidence that entry rates are lower in industries with high ratios of advertising expenditures to sales. He suggests that among advertising intensive industries, entry appeared to be deterred only where capital commitments were important.

More profound research of the effect of advertising on entry was conducted by Kessides (1986, 1991). These two papers present and test several hypotheses about the entry-deterring effects of advertising. The model isolates two separate effects of advertising on entry: the effect on the irrecoverable costs of entry (sunk cost); and the effect on the uncertainty underlying the entry environment. He found that advertising impeded entry since adverting expenditures give rise to a sunk cost which raises the risk of entry. However, there is another perspective of advertising. Since advertising is an instrument of persuasion, it increases brand loyalty, reducing the perceived number of product substitutes by enhancing differentiability. Therefore, entrants may perceive a greater likelihood of success in markets where advertising is important.

Theses two conflicting forces of advertising, the effect of raising sunk cost and the effect as instrument of persuasion, can partly offset each other, but the overall impact of advertising on entry is positive according to Kessides (1991).

There seems to be little doubt that heavy advertising makes entry more difficult for many new firms. It is certainly the case that advertising can inflate the entry costs faced by entrants. Nevertheless, advertising is hardly an exogenous structural feature of markets (Sutton, 1991); it is associated with other market characteristics such as product differentiation or product quality. In this sense, it could facilitate entry.

*B) On the exit side*

Because advertising costs turn to sunk cost, one can expect advertising to also act as a barrier to exit. The extent of the sunk cost argument is confirmed in several papers. In the study of the symmetry between entry and exit in Greek manufacturing industries, Fotopoulos and Spence (1998) found that as a proxy for product differentiation, advertising plays an important role in deterring both entry and exit. That is probably due to the considerable sunk cost they imply and the competitive advantages they create in favor of the incumbents firm. This result stays in line with Shapiro and Khemani (1987).

### 2.2.3 R&D intensity

*A) On the entry side*

R&D intensity is another source of barriers to entry. Just like advertising intensity, R&D intensity is often measured by industry R&D expenditures as a percentage of

industry sales. R&D acts as a barrier to entry by raising entry costs. Early results suggested that the negative effect of R&D on entry was modest (Orr, 1974a) compared to other major entry barriers. Many studies have shown that small firms face a severe scale disadvantage with respect to R&D (Acs and Audretsch, 1989).

Similar to advertising, R&D may have two conflicting effects on entry. Besides the deterrence effect, R&D is also a proxy for innovation. Geroski (1995) suggests that "entry is often used as a vehicle for introducing new innovation, frequently because incumbents are more interested in protecting existing rents than in seeking out new profit opportunities" (p.11). He also points out that high rates of entry are often associated with high rates of innovation.

R&D intensity may also be an indicator of product innovation which may induce entry. In highly diversified industries as well as in industries with rapid technological development, entry may be facilitated by the opportunities for developing product niches (Highfield and Smiley, 1987). Meanwhile, firms are more likely to adopt aggressive entry deterring strategies in research intensive industries (Bunch and Smiley, 1992).

Although the sign of the R&D intensity term is ambiguous, it is safe to say that R&D deter of small firm entry.

*B) On the exit side*

Because R&D expenditures reflect sunk costs, R&D may also act as an exit barrier. In addition, R&D as a barrier to exit may result from the fact that R&D may enhance the viability of incumbents through innovation.

Some empirical studies confirm the negative effect of R&D on exit. Kleijweg and Lever (1996) report that exit appears to be lower in R&D intensive industries in the Netherlands. The same result is found in Doi (1999). He observes that R&D has a negative and significant effect in Japanese industry, indicating that R&D discourages exit. This finding implies that although R&D may induce less innovative firms to exit (Audretsch and Mahmood, 1994), more incumbents actually benefit from technological innovation.

### 2.2.4 Capital requirement and Capital intensity

The capital requirement is defined as the cost of fixed capital required to establish a plant of minimum efficient scale (Dorr, 1974a). Capital intensity is often captured by the capital-labor ratio (Lay, 2003) or the capital-output ratio (Doi, 1999). These two variables are used in entry equations because they are positively related to costs of entry, which are used to proxy for absolute cost barriers to entrants. Also, they are correlated with the magnitude of sunk costs, which may reduce both entry and exit.

The negative effects of capital intensity on entry and exit are found in a great amount of papers (Ace and Audretsch, 1989; Dunne and Roberts, 1991; Lay, 2003). An exception is Doi (1999). In his study of exit, the capital-output ratio unexpectedly has a positive sign. The explanation provided is that in capital-intensive industries, less efficient or failing firms tend to exit. A similar result is reported in Kaya and

Üçdoğruk (2002). If an industry is highly capital intensive, the survival of entrants will be difficult, therefore causing more exit.

As to the capital requirement, the results are similar. While most papers confirm that high capital requirements deter both entry and exit, the opposite result is found in a few cases (e.g.: Lay, 2003).

### 2.2.5 Concentration

*(A) On the entry side*

High market concentration may discourage entry, since it makes it easier for incumbents to coordinate aggressive actions against new entrants. Concentration, therefore, deters entry to the extent that the potential entrants perceive a higher probability of an aggressive response in more concentrated industries.

The deterrence effect of high concentration on entry is documented in many recent papers, including Ilmakunnas and Topi, 1999; Kaya and Üçdoğruk, 2002; Roberts and Thompson, 2003 and Hölzl and Sögner, 2004. But exceptions exit. Masson and Shaanan (1987) replicated their earlier tests (Masson and Shaanan, 1982) which uses the U.S. data with Canadian manufacturing industries data during the period 1960-1963. Comparing their results, they show evidence indicating that greater concentration increases entry in U.S. industries and decreases entry in Canadian industries. One plausible explanation depends upon the potential entrant's assessments of the ease of collusion in the industry. In the U.S., entry would be more likely to occur if concentration were high than if it were at intermediated levels. One

the other hand, market concentration may leave niches, which may be filled by small innovative firms (Acs and Audretsch, 1989). Therefore, concentration may attract small firm entry.

*(B) On the exit side*

Concentration influences exit since opportunities for collusion allow firms to survive easier in periods of low demand. In concentrated industries, many firms may be protected from competition. Therefore, the level of industry concentration may be negatively associated with exit.

The negative effect of concentration on exit is found in some papers focusing on the study of the determinants of exit. In Doi (1999), which presents evidence on the determinants of firm exit in Japanese manufacturing industries over the period 1981-1989, a significant and negative relationship is found between concentration and exit. This finding is consistent with Flynn (1991). It seems that highly concentrated industries have high entry barriers and therefore a low turbulence among firms once they have entered. Thus, in concentrated industries, the extent of exit is relatively small and industry structure is likely to be stable. Similar results are also found in the comprehensive papers dedicated to both entry and exit. Roberts and Thompson (2003), using Polish data, confirm the deterrence effect of concentration on entry and exit. Similar results are also found in Kaya and Üçdoğruk (2002), when use data on Turkish manufacturing industries from 1981 to 1997.

### 2.2.6 The symmetry hypothesis

It is a stylized fact that entry and exit are highly and positively correlated (Geroski, 1995). The hypotheses of symmetry which considers that entry barriers deter exit and vice versa, is one possible explanation for the high correlation between the rates of entry and exit. On the one hand, investing in assets involving sunk costs is a requirement for entry and, if the potential entrant effectively becomes an incumbent, the investment eventually becomes a disincentive to exit. On the other hand, these barriers to exit can also raise barriers to entry because they can alter the expectations of potential entrants. From these empirical results, we can see that in practice, strong support of the symmetry hypothesis is hard to obtain. Many studies seem to be at least partially supportive.

Shapiro and Khemani (1987) examine the symmetry hypothesis between entry and exit barriers using Canadian cross-section data. The entry equation used follows the tradition of the Orr (1974a) model, and the exit equation is similar but not identical. The results reveal a considerable degree of symmetry in the behavior of entry barriers as determinants of both entry and exit. This result is widely quoted in support of the symmetry hypothesis.

Fotopoulos and Spence (1998) study the symmetry in entry and exit in Greek manufacturing between 1982 and 1988. By using a formulation similar to Shapiro and Khemani (1987), their results tend to confirm the symmetry hypothesis for factors determining entry and exit. Similar results are found in Lay, 2003 and Hölzl, 2004.

Nevertheless, Rosenhaum and Lamort (1992) reject the symmetry hypothesis in American manufacturing industries. Similarly, Carree and Thurik (1996) find little evidence of symmetry in their results.

In addition, from the empirical evidence discussed above, we note that: 1) most entry barriers reflect two market structural characteristics: product differentiation (e.g. advertising, R&D) and economies of scale (e.g. MES, capital intensity, advertising and R&D); 2) traditional entry barriers (employed in Orr, 1974a) deter entry in most cases; 3) barriers to entry tend to keep their sign across the entry and exit equations but are not always significant.

## 3. Firm-specific factors

Beside the industry-specific factors mentioned above, firm-specific factors influence entry-exit as well according to many empirical studies. In this section, we will mainly consider two firm specific factors: firm entry type and firm size.

### 3.1 Firm entry type

That entry barriers may affect potential entrants in different ways according to firm entry type has long been recognized in the literature. The idea that entry barriers may pose different challenges to different entrants was introduced by Hine (1957). He distinguished between de novo entry and entry by already established firms,[3] arguing that the latter would be in a better position to overcome the burden of entry barriers

[3] This kind of entry is also named as extension entry including diversifying entry or expanding entry.

than de novo entry. De novo entry is usually defined as entry into an industry by forming a new company or plant as opposed to combining with an existing firm in the industry. Thereafter, a number of other distinctions among entrants have been made, and the different determinants of those types of entry have been compared.

The hypothesis that entry barriers have different effects on different types of entrants was tested by Gorecki (1975), who differentiates between entry by specialist and diversified firms. He concludes that while specialist firms are affected by economies of scale and advertising, diversified firms are not. He also finds that, among specialists, those operating in more than one industry are less likely to be deterred.

Khemani and Shapiro (1988) divide entrant plants according to the parent company, and study the effect of entry barriers on entry deterring profit levels for different types of entrants. They conclude that only de novo entrants are sensitive to entry barriers.

Although various distinctions of entrant type were introduced in the literature, most of them are developed from the basic form: de novo entry and extension entry. The study of de novo entry attracts great attention. Mata (1993) found that de novo entry is sensitive to most entry barriers, and even deterred by the entry of firms established in the industry. This result is confirmed by Kleijweg and Lever (1996). They showed that high capital intensity and advertising intensity seem to be a high barrier for de novo entry while it is not for extension entry. These two papers also

share another point: extension entry can easily overcome the scale economies barrier, being even attracted to industries where these economies are important.

In general, these studies show that the determinants of entry are different according to the type of entrant. Conventional entry barriers seem to affect de novo entry most while extension entry may have some advantages to overcome those barriers. Therefore, it is not surprising that de novo entrants have low survival rates (Geroski, 1995).

### 3.2 Firm size

The determinants of entry and exit according to firm size have attracted great attention in recent decades. Many papers found that the impact of different determinants of entry and exit vary with firm size. This section will focus on the different impacts of industry factors on entry-exit between large firms and small firms.

White (1982) analyses the question why small firms flourish in some sectors and not in others. His results indicate that small firms appear to be more important in less capital intensive industries, those less vertically integrated, and those in fast growing industries serving local markets. Interestingly, advertising intensity was not found to be a source of particular disadvantage for small firms, indicating that smaller firms may have found alternative survival strategies.

Following this lead, Acs and Audretsch (1989) seem to be the first paper which summarizes the different strategies used by small firms in order to enter and survive

in a industry. By examining a cross-sectional data set from 1978 to 1980 in the U.S., they use small firm entry rate as a dependent variable and adopt a linear form of entry model (Orr-type), where the right hand side variables are the growth rate, price-cost margin, advertising intensity, R&D intensity and concentration and the explained variable is small firm net entry rate.

The empirical results show that small firm entry is different from large firm entry in the following ways: past growth rates provide stronger incentives for small firm entry; while the past profit rate induces entry only in firms with at least 250 employees; moreover, small firm entry is more likely to be deterred by R&D intensity and advertising intensity. On the other hand, small firms could be partially compensated for their inherent size disadvantage by pursing a strategy of product innovation, entering industries that are highly unionized, and industries in which the scale disadvantage of small firms has been diminishing.

Mata (1991) studies the role of sunk costs on entry varying with firm size. The model uses large and small scale entry as the dependent variable respectively in order to test whether the two types of firms respond differently to sunk costs. In this paper, sunk costs appear to be important only for large entrants. This is probably because small-firm formation relies heavily on the second-hand market[4], where small firms reduce the commitment to the market and the risk involved with entry. In addition, he found all the conventional entry barriers (advertising intensity, R&D intensity, capital requirement, minimal efficient scale etc) were negative and significant in the

[4] Small firms usually start their business buying cheap second-hand equipment.

small-scale entry, while not in the large-scale firm entry. Contradicting the previous result found in Acs and Audretsch (1989), he found that the past profitability of the industry only appears to be significant for small firm entry, while only large entrants respond to industry growth. More importantly, this paper challenges the conventional view of small business flexibility and their superior ability to succeed in environments where large firms fail. More sophisticated methods of forecasting post-entry profitability adopted by large firms enable them to perform better than small entrants.

Different from the cross-sectional approach used in the above studies, Wagner (1994) uses a panel of 29 manufacturing industries for the region of Lower Saxony. The results reveal that small firm entry occurs in industries characterized by higher degrees of growth, past profits and concentration in the times of higher unemployment and higher interest rates. Both capital intensity and R&D are negative, but the latter was not significant at any conventional level.

A more comprehensive and elaborated research was performed by Fotopoulos and Spence (1997). Adopting the view that size matters in understanding entry-exit patterns, they explore the nature and causes of net entry patterns of various size-defined groups of establishments in Greece. One major contribution of this paper is a finer and clearer size-defined structure of firms. Firm are classified into five groups by the number of employees instead of sliding cut-off points, discriminating between small and large firms. The results obtained seem to indicate that there is a gradation in the responses of different size classes to define at the industry level. Some limited evidence is offered that small firms are different in that they manage to

overcome entry barriers, perhaps adopting different survival strategies, and that large firms are well aware of market conditions and are in an advantageous position to overcome many of the problems. Size classes in the middle of the distribution offer rather mixed results due to size related advantages and disadvantages.

Exit, in turn, as the other part of the industry turnover process, is more likely to happen to small firms. Studies based on growing as well as declining industries have found that smaller firms have higher exit probabilities. Dunne et al. (1989) confirmed this relation between exit and firm size using broad, cross-sectional data. By examining patterns of post-entry employment and failure for over 200,000 plants that entered the U.S. manufacturing sector in the 1967-1977 period, they found that within any age category, failure rates decline with increases in the plant's current size.

Lieberman (1990) used data on 30 chemical products to examine the sequence of divestment in declining industries. The findings are consistent with multiple theories: small-share firms exhibited high rates of exit, and small-scale plants were most likely to close. The size of the incumbents is negatively related with exit in declining industries. Small firms are more likely to just close down, whereas large firms tend to opt for incremental capacity reduction through the closure of plants.

The study done by Wagner (1999) contributes to the literature on exit by exploring a rich longitudinal data set that was collected by annual personal interviews in some 1000 establishments from German manufacturing between 1994 and 1996. His findings support the stylized facts that the likelihood of a firm exiting declines

with both age and size, suggesting that the bulk of firms exiting from the industry tend to be new and small enterprises.

The studies reviewed above make it clear that firms of different size, and especially small firms, should be viewed as a behaviorally distinct group within industries and not as a "scaled down" version of their larger counterparts. The entry-exit process is not independent of firm size.

**4. Entry and exit over the industry life cycle**

An industry typically experiences initial mass entry and later a shakeout of producers where inefficient firms are forced to exit and eventually cause zero firm entry situations. Entry and exit conditions vary over time in an industry's life cycle when competitive advantage among firms is changing.

Gort and Klepper (1982) applied life cycle theory to the study of entry and exit. They examined 46 products in the U.S. over most of their life cycle. They defined five stages: stage I begins with the first commercial introduction of a new product by the first producer; stage II is the sharp increase in the number of producers; stage III is the period where the number of entrants is balanced by the number of exits, leaving the net entry approximately zero; stage IV is featured with negative entry, and finally stage V is defined as the second period of zero net entry. The model they use to examine the probability of entry during different stage can be stated as:

$$P_t = f( I_{2t}, L_t, \pi_t )$$

Where $I_{2t}$ represents the number of innovations at time t; $L_t$ is the accumulated stock of experience of incumbent producers; $\pi_t$ stands for the profit of incumbent producers at time t.

Their results suggest that the entry rate accelerates at the beginning of stage II due to innovation and profit. Then from stage II to III, the entry rate declines drastically to a point of zero net entry. Three reasons are given to explain the decline: a) the accumulation of experience by the existing firms operating as entry barriers; b) the eventual decrease in profits resulting from the increase in the number of entrants; and c) the gradual reduction in the number of potential entrants. They found that new industries generally pass through a stage in which the number of producers declines significantly. In addition, they calculated that the number of producers was reduced by 40% through rationalization.

Building on the work of Gort and Klepper (1982), Gort and Agarwal (1996) show equivocally the key role the life cycle plays in determining entry and exit. Entry rates appear to be affected profoundly by stage-related changes in both the rate of technological advance and the form innovation takes. Exit is determined largely by stage-related changes in the intensity of competition.

Another extension of the industry life cycle theory is the shakeout effect on entry and exit. Shakeout describes an industry experiencing substantial entry, followed by a lengthy period in which there is a persistent fall in the number of firms despite continued growth in output (Gort and Klepper, 1982). Based on shakeout theory, Klepper and Miller (1996) develop a model to account for shakeouts in the entry and

exit process. The model allows products to experience shakeout of different lengths and severity. It suggests that for products that experience shakeouts, entry should decline over time, especially after the peak in the number of firms attained in an industry, and exit should peak after entry and then decline in tandem with entry. For non-shakeout products, it suggests that entry should decline overtime and exit should be flat.

**5. The interdependence of entry and exit**

The high correlation between entry and exit is confirmed by most studies. Many studies have shown that if entry barriers are high, one could expect that also exit barriers are high, since incumbent firms that once have succeeded in entering the market could be unwilling to exit. The correlation comes from the fact that both entry and exit are affected by the same factors as discussed in the pervious section. Beyond the consideration of entry and exit as independent processes, a reasonable question to be addressed is whether entry and exit have a mutual effect on each other.

There are three possible types of interdependence of entry and exit proposed and tested by many empirical studies: displacement (entry leads to future exit); replacement (exit leads to new entry); demonstration (entry leads to new entry).

## 5.1 Displacement

The displacement effect[5] suggests entry as a cause of exit. There are several reasons to believe that such interdependence exits. Due to cost heterogeneity, there may be a fringe of high-cost incumbents who can be displaced by lower-cost entrants (Shapiro and Khemani, 1987). In other words, a new entering firm is more effective, resulting in excessive production capacity and therefore forcing other less effective firms to exit. Second, because of innovation and technological change, new entering firms produce a superior good in terms of quality or other product characteristics and this might also force existing firms to exit.

Shapiro and Khemani (1987) examine the interdependence between entry and exit, along with the testing of the symmetry hypothesis. The displacement effect is estimated by adding a new term capturing the displacement effect into commonly used entry and exit equations. The traditional entry and exit equations are presented as follows (p.17):

$$\text{Ln Entry} = f_1 (\text{Barriers to entry, incentives, control variables}) + e_1 \quad (1)$$

$$\text{Ln Exit} = f_2 (\text{Barriers to exit, incentives, control variables}) + e_2. \quad (2)$$

The positive estimated correlation ($r = 0.49$) between the error terms $e_1$ and $e_2$ indicates the existence of displacement. This suggests that displacement must be modeled explicitly. By adding a new term respectively to each equation, equations (1) and (2) become (p.20):

$$\text{Ln Entry} = f_1 + g_1 (\text{Exit}) + u_1 \quad (3)$$

[5] This effect is also called the competition effect in some papers.

$$\text{Ln Exit} = f_2 + g_2 (\text{Entry}) + u_2 \quad (4)$$

In equation (3), the new term represents the potential for successful displacement. The new term in equation (4) represents actual displacement caused by successful entry. The magnitude of the displacement effect of entry is estimated by the entry coefficient in the exit equation. Since both entry and exit are measured in logarithms, this coefficient may be interpreted as the elasticity of displacement. The result shows the elasticity of displacement is 0.78, which suggests that the displacement effect is substantial.

The results of Shapiro and Khemani (1987) reveal entry as an important determinant of exit but the degree of observed symmetry is substantially lower. The interpretation is that potential displacement is more likely to happen the larger an industry is. The important conclusion made concerning entry and exit interdependence is that barriers to entry restrict displacement and exit.

Carree and Thurik (1996) examine displacement and replacement for a panel data-set of 23 Dutch retailing industries for the 1981-1988 period. In their study, they categorize the displacement effects into two cases. One is that new entry leads to involuntary exit. The other is that incumbents who seriously consider exit may wait for new entrants to take over their business. Two major contributions are made by this study. Firstly, because displacement or replacement is not immediate but take place in the following period, they incorporate lagged entry and exit rates in the model. Second, they test the hypothesis of exogeneity of the exit (entry) rate in the entry (exit) equation. They find evidence for displacement and replacement processes. In addition,

they also refute the simultaneity of the entry and exit rates which, on the other hand, supports the exogeneity hypothesis. Finally, they assert that the entry and exit rates cannot be expressed as functions of market incentives and barriers only. When characterizing the determinants of industry entry and exit, it is important to take into account the interdependence between the two processes.

Kleijweg and Lever (1996) categorize exit into two sources: general exit and exit by bankruptcy. This distinction of exit offers a method to test the extent and level of displacement effect on different types of exit. The results support the significant and positive effect of lagged entry rate on both kinds of exit, indicating that entry forces firms to exit, no matter if exit is voluntary or not.

As its existence has been confirmed by many papers, the displacement effect gives the key to solve the conflicting empirical results[6]: why many papers fail to validate the conventional theory that firms enter when super-normal profit is positive, and exit when it is negative. Geroski (1995) gave details of the picture about how displacement happens in the real world: "In short, entry and exit seem to be part of a process of change in which large numbers of new firms displace large numbers of older firms without changing the total number of firms in operation at any give time by very much."(p.4). The displacement effect affects young, new firms most severely. The survival rate of most entrants is low. Especially, as a more common method of entry, de novo entry is less successful than entry by diversification.

[6] While many papers confirm that profitability attracts entry and deters exit, some other empirical studies (e.g. Dunne and Robert, 1991 and Rosenhaum and Lamort, 1992) found profitability is positively correlated with both entry and exit, see page 6.

Geroski also provides evidence of displacement by pointing out that both firm size and age are correlated with the survival and growth of entrants. The likelihood of firm failure is inversely related to age (Dunne et al. 1988). It seems that new entering firms have a higher probability of failure than incumbents which have been in the same market for years. Based on this argument, we could say that most firms entering today are exiters tomorrow. As the "revolving door" metaphor (Audretsch, 1995) used to describe a situation where the bulk of new entrants subsequently exit from the industry, this view seems to imply that there is a close match between the identities of entering and exiting firms in the short run. Another implication is that the likelihood of firm survival is positively related to firm size. Given the fact that most new firms are extremely small, we can expect a high correlation between entry and exit rates.

The dynamics of entry and exit are widely accepted and evaluated in most of the papers as explanatory variables in the entry-exit process. Fotopoulos and Spence (1998) find that the larger an industry, the larger the possibility for successful displacement becomes; furthermore, the larger the industry fringe is compared to total industry size, the more probable it is that a great deal of displacement might occur especially at the industry fringe.

Ilmakunnas and Topi (1999) illustrate the displacement effect over time by introducing lagged entry as a determinant in the exit equation. This is a standard method used to evaluate displacement in most recent papers (Kaya and Üçdoğruk, 2002; Lay, 2003, Roberts and Thompson, 2003; Hölzl, 2004). Their results suggest

that past entry has a significant positive effect on exit, indicating a significant displacement effect in Finnish manufacturing industries.

A more sophisticated approach to test displacement is applied in Nyström (2005). This paper investigates the dynamics of firm entry and exit with a focus on differences between industrial sectors by using panel data during the period 1991-2000. Given that $\partial$ exit $_t$ / $\partial$ entry $_{t-1}$ is positive in the exit equation, displacement is confirmed. He further estimates the correct lag length of previous entry in the exit equation. The results suggest a proper lag length is three, which can be compared with the result of Johnson and Parker (1994) who found a lag length of six years for entry. In addition to the lagged entry variables, time dummies were also included. Finally, the estimations, once more, show a positive and significant effect of lagged entry on exit.

### 5.2 Replacement

Another hypothesis about the interaction of entry and exit is the replacement effect. As a reverse process of displacement, replacement is defined as the positive effect of exit on entry.

An examination of the inter-industry pattern of entry and exit in U.S. manufacturing by Evan and Siegfried (1992) confirms that exit causes entry by the possibility that new entrants are attracted to the room left by prior exits. Their empirical results suggest that total firm entry during the period 1977-1982 is determined by exit during the same period and by no other variables.

An alternative explanation depends on resource release through exit. For example, Brown et al. (1990) suggest an evolutionary, 'trees of the forest' approach, with exit feeding back into entry by freeing resources which can be used for further entry by more able entrepreneurs. Storey and Jones (1987) consider such a possibility with respect to physical assets, on the grounds that second-hand equipment will be available cheaply where exit is frequent. Entrepreneurial resources can also be released through exit, for example where redundancy as a result of exit provides the spur to self-employment.

The possibilities of replacement are summarized by Carree and Thurik (1996): first, exit provides additional market room for potential entrants; second, firms may wait to enter until they are offered the opportunities to take over a shop, which is equivalent to a resource release argument.

A general method used to test the replacement effect, similar to that used to test displacement, is adding past entry as an explanatory variable into the traditional entry equation as follows:

$$\text{Entry} = \alpha + \beta\,\text{Exit} + \delta X + \varepsilon$$

where X is a vector of exogenous determinants of entry. This entry model is used in Love (1996).

While there is a direct causal mechanism running from entry to exit, the potential effect of exit on entry is much more indirect. A positive coefficient of entry in exit equations is found in a few papers (Love, 1996; Carree and Thurik, 1996; Roberts and Thompson, 2003). The strongest evidence is reported in Kleijweg and Lever, (1996).

In their study, the estimated impact of lagged general exit on new firm entry[7] is insignificantly different from unity, which points to a high replacement rate.

Not all papers confirm the presence of a replacement effect. Using Taiwan's industry data, Lay (2003) found that current entry is not affect by previous exit.

Compared to the straightforward displacement effect, replacement seems to be more ambiguous. The birth of firms will eventually cause death. But it is not always true that new entry is the result of exit.

### 5.3 Demonstration

The third aspect of interdependence between entry and exit is called the demonstration effect[8] which implies that current entry causes future entry. When a new firm enters, it stimulates others to do the same since it makes people aware of the markets or the possible shortcomings of those markets that could be satisfied by starting a new firm. The "demonstration effect" was perhaps first referred by Gort and Konakayama (1982). They argue that the perception of profit opportunities is positively related to the successful experience of others in the market. Entrepreneurial activity may very well tend to be autocorrelated: the incidence of entry may stimulate entrepreneurs to consider entry as well.

The demonstration effect can easily be linked to theories on clusters and spillover effects following Marshall's (1920) theories on agglomeration. These theories state that firms can benefit from each other in several ways. Firms can, according to these theories,

[7] They estimate two kinds of entry: new firm entry and diversifying or expanding firm entry.
[8] Johnson and Parker (1994) call it the multiplier effect.

benefit from a shared skilled-labor market, accessibility to local inputs and information spillovers.

Carree and Thurik (1996) include the demonstration effect in both entry and exit equations. The lagged exit rate has a significant positive effect on the present's exit rate. They suggest that firms change their range of activities shifting to another shoptype, may be followed by competitors.

By incorporating past entry rates in the entry equation, the demonstration effect can be easily estimated. As presented in Lay (2002), a complete entry equation considering both displacement and demonstration could be:

$$Entry_t = a + b\,X + c\,Entry_{t-1} + d\,Exit_{t-1} + \varepsilon$$

where X is a vector of industry specific factors or market conditions that affect entry. A positive and significant coefficient of lagged entry rate in the entry equation indicates the demonstration effect. This effect is empirically confirmed by Lay (2002).

This effect is also supported by Nyström (2005). By comparing displacement and demonstration effects, he also argues that among these two effects displacement is predominant. This result is supported by Lay (2003).

## 6. Conclusions

This paper reviews the empirical studies on the determinants and interdependence of entry and exit. There are four categories of the determinants of entry and exit: industry-specific factors; firm-specific factors; entry and exit over the

industry life cycle; and the interdependence of entry and exit. By comparing and summarizing empirical results using country-varied and time-varied data, the following points emerge. High profitability and strong market growth induce entry and deter exit. Conventional entry barriers significantly deter entry. Due to sunk costs, entry barriers are likely to deter exit as well. The symmetry hypothesis is partially supported by empirical evidence. In the long term, the industry life cycle plays an important role in determining entry and exit. Finally, regarding the interdependence between entry and exit, the empirical evidence strongly supports the displacement effect, while support for the replacement and demonstration effects is mixed.

A few suggestions can be made for future studies. Most of the existing works focus on manufacturing industries. With the development of the world economy, more studies could be conducted on newly emerged industries. In addition, due to data constraints, the majority of the empirical works are done for the developed countries and more work on this issue is needed for developing countries.

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