Rev Ind Organ (2007) 31:23–42
DOI 10.1007/s11151-007-9144-x

Foreign Ownership, Competition, and Survival Dynamics

Erol Taymaz · Şule Özler

Published online: 14 September 2007

Abstract The impact of foreign direct investment on host countries' industrial sectors has received considerable attention. It is shown by many researchers that foreign plants are more productive than are domestic ones, but the empirical evidence regarding spillovers is not unambiguous. In this paper, we suggest that the impact of foreign direct investment on local industry hinges on the dynamics of foreign and domestic plants—i.e., on entry and selection (exit) processes. Our analysis of foreign investment and competition dynamics in Turkish manufacturing industry for the period 1983–2001 indicates that foreign plants have a better performance level than do domestic ones when they are first established in the local market, and, subsequently, are more likely to survive but; the difference in survival probabilities disappears when the industry and/or plant characteristics are controlled for. Moreover, foreign presence seems to have no long-term effect on the survival prospects of domestic plants.

Keywords FDI · Firm dynamics · Survival · Turkish manufacturing industries

JEL Codes F23 · L25 · L60

1 Introduction

The post-war period has witnessed a rapid increase in international economic activities and, most importantly, in foreign direct investment (FDI) in developing countries. The

E. Taymaz (✉)
Department of Economics, Middle East Technical University, Ankara 06531, Turkey
e-mail: etaymaz@metu.edu.tr

Ş. Özler
Department of Economics, University of California, LA, Box 951477, Los Angeles, CA 90095-1477, USA
e-mail: ozler@econ.ucla.edu

rise in FDI has attracted the attention of industrial and development economists, especially since the late 1960s. It is suggested that FDI would contribute to the growth of developing countries through technology spillovers (imitation, demonstration effects, training local labor, etc.) and competitive pressures exerted on domestic firms.

There are various empirical studies that document the technological superiority of foreign over domestic ones in a number of developing countries. This is indeed the case even in developed countries. Although productivity differences between foreign and domestic plants could be explained by other factors like plant size, capital intensity, etc., this is one of the most robust empirical findings on FDI.

The pertinent question for policy purposes is the effects of FDI on domestic industry and firms because the technological superiority of foreign firms *per se* does not necessarily imply any productivity benefit for the host economy's firms. Therefore, researchers search for spillovers from foreign to domestic firms, and productivity enhancing effects of FDI. Thanks to the availability of longitudinal firm/plant data, recent studies explore spillovers at the firm/plant level. Although foreign firms are larger, more productive, and more capital and skill intensive than their domestic counterparts in both developed and developing countries, the extent of spillovers is not unambiguous.[1]

Although the current literature on FDI provides valuable information on multinational firms and their effects on host economies, most available evidence in this field has to do with multinationals' and host countries' (static) characteristics rather than the process of competition. We believe that the competition process is indeed the missing link that is crucial for our understanding the interactions between foreign and domestic firms, and, hence, the effects of FDI on the host economy. For example, the presence of FDI may increase average productivity of domestic firms by forcing them to be more productive and/or eliminating inefficient domestic firms by intensified competition as well as through technology spillovers (Blomström and Kokko 1998). Therefore, a simple positive correlation between the presence of FDI and higher productivity, as found in some studies, does not necessarily imply the existence of spillovers from foreign to domestic firms.

The aim of this paper is three-fold: to analyze i) differences in entry characteristics of foreign and local firms, ii) differences in survival patterns of foreign and domestic firms, and iii) the effects of FDI on the survival prospects of domestic firms in Turkish manufacturing industries.

The rest of the paper is organized as follows: Section 2 formulates the hypotheses to be tested in this paper. Section 3 presents a descriptive analysis of entry-level characteristics and survival rates of foreign and domestic plants in Turkish manufacturing industries. The estimation results of an econometric analysis of the survival process are discussed in Section 4. Major findings and policy implications are summarized in Section 5.

[1] For a review, see Görg and Strobl (2001), and Bellak (2004). For a recent study on the Turkish case, see Lenger and Taymaz (2006).

2 Dynamics of Firms and Foreign Ownership

The increased availability of panel data on firms/plants in the last few decades has sparked a large number of both empirical and theoretical studies on the dynamics of firms. Most of these studies are influenced to a large extent by the path-breaking theoretical analyses, among others, of Nelson and Winter (1982), Jovanovic (1982), Hopenhayn (1992), and Ericson and Pakes (1995), who emphasize the importance of uncertainty and learning. The empirical work on the determinants and effects of entry, exit, and growth processes has provided a great deal of "stylized facts" that are observed in many countries and/or sectors. Since it is beyond the scope of this paper to discuss all these studies (for comprehensive surveys, see Audretsch and Siegfried 1992; Siegfried and Evans 1994; Geroski 1995; Caves 1998), we will briefly summarize the main findings to formulate some hypotheses on differences between the dynamics of domestic and foreign firms.

One of the strongest findings about the entry process is the stylized fact that entrants are usually smaller than incumbents when they start, even if economies of scale are important. This phenomenon can be explained by two factors: First, as emphasized in learning models and real options theory, the entry process is surrounded with uncertainty, and entrepreneurs may not exactly know how well they will perform in the market. It may be rational to start small so as to limit sunk commitments, even if doing so imposes a cost penalty, and tend to invest more and grow after gathering information on the start-up firm's (potential) performance.

Second, new firms may start small because of asymmetric information and capital market imperfections (the liquidity constraint). If these constraints are important, then one may expect differences between entry characteristics of (single plant) domestic and foreign firms because foreign firms are mostly multi-plant firms that diversify into a different (geographical) market. Therefore, uncertainty arising from establishing a new establishment will be less severe for a foreign firm that produces the same product. Moreover, an established, multinational firm can have adequate internal and external funds to finance new investment because it may have a better reputation with financial institutions. Thus, the start-up (entry) size of foreign establishments is expected to be larger than that of domestic establishments, and foreign firms are likely to enjoy the benefits of large start-up size, at least, in the early years of their existence.

Most new entrants are small, and they never overcome the competitive pressures. Entrants suffer from high mortality rates, and there seems to be a strong positive correlation between entry size and the survival probability. However, the literature does not offer much about the impact of (foreign) ownership on survival probability. On the one hand, it is suggested that foreign firms are "footloose", because they can easily re-allocate their resources to other countries as a reaction to adverse changes in the host country (Gibson and Harris 1996; Görg and Strobl 2003b). In other words, foreign firms may have lower exit costs that make exit probability higher. On the other hand, foreign firms on average may have superior technological and managerial skills that enable them to develop successful entry strategies. Therefore, self-selection before entry may increase the survival probability of foreign firms.

There are only a few studies that use (panel) data on both domestic and foreign establishments, and the findings are ambiguous. For example, Li and Guisinger (1991) and

Gibson and Harris (1996) have found that foreign firms are less likely to exit whereas Bernard and Sjöholm (2003), Görg and Strobl (2003b), Pérez et al. (2004), Baggs (2005), and Masso et al. (2005) had an opposite result. Similarly, Girma and Görg (2001) have found that the acquisition of a domestic establishment by a foreign owner reduces its survival probability. Mata and Portugal (2002), Kimura and Kiyota (2007), and Söderbom et al. (2006) have found for Portugal, Japan, and Ghana, Kenya, and Tanzania, respectively, that domestic and foreign firms do not exhibit different survival probabilities. The empirical findings of Mata and Portugal (2002), Bernard and Sjöholm (2003) and Alvarez and Görg (2005) suggest that firm and industry characteristics play more important roles than does ownership in determining the survival rates.

The presence of foreign plants will change competitive conditions in the market. Foreign plants are likely to intensify competition, and may force domestic plants out of the market (Caves 1974; Blomström and Sjöholm 1999). This has, of course, efficiency-improving effects because the least efficient domestic plants tend to exit first. However, domestic plants may benefit from spillovers from foreign firms, and become more competitive in domestic and, more importantly, in international markets. If the spillover effect is dominant, then the survival probability of domestic firms will be enhanced by the presence of foreign firms in the same market.

Two recent studies by Coucke (2005) and Masso et al. (2005) on Belgium and Estonian manufacturing, respectively, found that (the increase in) the market share of multinational/foreign firms reduces the survival probabilities of domestic firms; i.e., the "competition effect" dominates the "spillover effect". However, Görg and Strobl (2003a) show in the Irish case that the presence of foreign firms may have a life-enhancing effect on domestic establishments in high technology sectors. Alvarez and Görg's (2005) findings suggest that the presence of foreign firms has no effect on plant survival in Chilean manufacturing, after controlling for productivity in exit regressions. In the case of Turkey, the competitive effect is expected to be dominant because domestic firms' R&D expenditures are very low; i.e., foreign presence is likely to reduce domestic establishments' survival probability.

The presence of foreign firms will change competitive conditions not only for domestic establishments but for other foreign establishments as well. It is suggested that a foreign presence may generate positive information externalities for foreign entrants. Görg and Strobol (2003a) found that a foreign presence has no effect on foreign firms' survival in high technology sectors, but it has a positive impact in low technology sectors in Irish manufacturing. Coucke (2005) suggested that the increase in the market share of multinational companies reduces the exit probability of multinational firms, but this finding may simply reflect the industry-growth effect rather than informational externalities. The study by Masso et al. (2005) on Estonia provides evidence that the market share of foreign firms in the industry has a positive impact on the survival probability of foreign firms, while the domestic firms' survival chances are reduced by FDI penetration. Thus, the empirical evidence indicates that foreign presence in an industry may enhance other foreign establishments' survival probabilities.

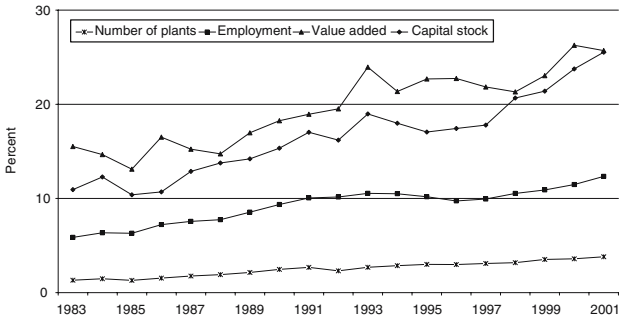

Fig. 1 Share of foreign firms in Turkish manufacturing, 1983–2001

3 Foreign Direct Investment in Turkish Manufacturing

The first legislation in Turkey governing the foreign investments was introduced in the early 1950s. Although the Law provided a quite liberal framework of general principles designed to create a favorable environment for FDI, inward foreign investment remained at low levels until the early 1980s, and the *cumulative* total of FDI authorized from 1950 to 1980 reached only US$229 million (Öniş 1994), partly because of some barriers for inward FDI and weak enforcement of rules and regulations (for barriers, see Findlay and Warren 2000; for governance- and institutions-related constraints, see Dutz et al. 2005). After the elimination of local equity participation and minimum export requirements in the 1980s (Erdilek 1986), and complete liberalization of Turkey's capital accounts in 1989, annual inflows of FDI reached almost US$1 billion in the 1990s. Although its share is declining over time, the manufacturing industry alone accounted for 55 percent of cumulative authorized FDI in the 1980s and 1990s. Privatization of public assets has attracted substantial FDI after 2002, and annual FDI inflows reached US$9.8 billion in 2005 and US$19.8 billion in 2006.

The share of foreign firms[2] in the total number of firms in manufacturing increased continuously from about 1 percent up to 4 percent in the late 1990s (Figure 1). Their employment share was 6 percent, with about 50,000 people employed by foreign firms in 1983. The employment share of foreign firms increased gradually, especially after 1988, and reached 12.4 percent in 2001. The share of foreign firms in Turkey's manufacturing capital stock has followed a pattern similar to the employment share, but it has been considerably higher than the employment share because foreign firms tend to use more capital-intensive technologies. The share of foreign firms in the capital stock was about 11 percent in 1983, but it exceeded 25 percent in 2001 following a rapid increase in the late 1990s.

Foreign firms are on average more productive than domestic firms. Consequently, their share in manufacturing value added is quite substantial. They produced about

[2] Following the usual convention, "foreign firms" are defined as those joint ventures where foreign ownership is 10 percent or more. Joint ventures with more than 50 percent foreign ownership are "majority-owned foreign firms".

15 percent of manufacturing value added in 1983, and increased their share almost continuously through 2001 (to 26 percent).

Table 1 summarizes the characteristics of domestic and foreign firms that were established after 1983.[3] The variables presented in Table 1 are also used in the econometric analysis in the following section. Since we expect significant differences in entry characteristics, the same statistics are provided for entry year observations. Finally, the data for "large" domestic firms are presented for comparison because foreign firms are on average larger than are domestic firms.

As is observed in many other countries, foreign firms in Turkey are characterized by larger size (in terms of the number of employees, the L variable), use of more capital-intensive technologies (KL), advertising intensity (ADVERINT), avoidance of explicit subcontracting relations (SUBINPUT and SUBOUTPUT), higher interest payments (INTPAY), higher profit rates (PMARGIN), higher wages (LW), and higher proportion of bonus-type payments in wage bill (BONUS). Moreover, foreign firms tend to operate in certain sectors (the FDIMSH variable), and the entry rates into these sectors are somewhat lower (ENTRATE). There is no significant difference in the growth rates of real output and output prices of sectors in which foreign and domestic firms concentrate. Foreign firms tend to operate in sectors where the growth rate of imports, especially from the industrialized countries, is lower. There is not much difference in export growth rates of foreign and domestic firms' sectors. Finally, foreign firms are established more in those sectors characterized by relatively higher degrees of concentration and minimum efficient scale.

It is interesting to observe the fact that most of these differences exist between foreign firms and *large* domestic firms. Moreover, the degree of foreign ownership seems to be not so important. There is not any significant difference between minority and majority owned foreign firms.

The data on entry characteristics reveal that foreign and domestic firms start their lives differently, and entry-time differences seem to persist (see the second part of Table 1). Most importantly, foreign entrants are almost three times larger than are domestic entrants. As discussed above, the difference in entry size could be explained by real options theory and liquidity constraints. First, since foreign firms may have more information about their performance and, possibly, on market conditions as a

[3] The data in Table 1 refer to all *private* establishments employing 10 or more people. The data source is the State Institute of Statistics (SIS) Longitudinal Database. "Plant" is the statistical unit. A "plant" (or establishment) is defined in the survey as a functional and decision-making unit that operates at a single location. All data, including the accounting data, are collected at the plant level. A plant is defined as "entrant" when it first appears in the database, and exit is defined similarly as exit from the database (an exit occurs in year t if the plant is observed in the database the last time in that year). A plant may exit from the database for reasons other than a real exit (shutdown). If a plant gets smaller than the threshold level (10 employees) for two consecutive years, it will exit from the database. That plant, of course, may reenter into the database if it grows. This aspect of the database is likely to cause an overestimation of the exit rate, and underestimation of the survival duration for small plants that employ about 10 people. Foreign plants are less likely to be affected by these transitions because they are on average much larger. We estimated our models for only medium-sized and large plants (that employ 25 or more people) that are less likely to exit from the database due to the threshold effect, and the results were qualitatively the same – possibly because of the fact that the "real" exit rate is also very high for small plants. If the owner of the firm changes as a result of an acquisition or merger, it will not be defined as "exit" as long as the plant remains in operation.

Table 1 Descriptive statistics (mean values for 1984–2001)

Label	Description	All observations				Entry level observations			
		Domestic	Large domestic	Foreign 10%+	Foreign 50%+	Domestic	Large domestic	Foreign 10%+	Foreign 50%+
Plant-level variables									
LL	Log number of employees	3.448	5.665	4.715	4.620	3.139	5.600	4.286	4.161
L	Number of employees	31	289	112	101	23	270	73	64
ENTRYLL	Entry level of employment	25	117	72	68	23	270	73	64
LLGR	Annual employment growth rate	0.022	0.115	0.057	0.055				
KL	Log capital/labor ratio	2.628	3.580	4.131	4.149	2.605	3.314	4.126	4.084
ADVERINT	Advertisement expenses/sales ratio	0.002	0.005	0.007	0.007	0.002	0.004	0.009	0.009
SUBINPUT	Subcontracted input share	0.032	0.056	0.039	0.039	0.027	0.040	0.041	0.039
SUBOUTPUT	Subcontracted output share	0.062	0.062	0.043	0.050	0.074	0.101	0.049	0.056
INTPAY	Interest payments/sales ratio	0.015	0.034	0.029	0.025	0.010	0.029	0.028	0.025
PMARGIN	Profit margin	0.244	0.291	0.328	0.337	0.252	0.291	0.310	0.312
BONUS	Share of non-wage benefits in gross wage	0.031	0.104	0.142	0.142	0.019	0.102	0.112	0.109
LW	Log wage rate	4.059	4.607	5.154	5.288	3.892	4.454	4.898	4.994
Industry-level (ISIC 4-digit level) variables									
FDIMSH	Market share of foreign establishments	0.111	0.105	0.200	0.202	0.099	0.100	0.186	0.184
FDIQGR	Output growth rate of foreign firms	0.115	0.118	0.123	0.127	0.154	0.161	0.149	0.152
QGR	Output growth rate	0.071	0.064	0.065	0.062	0.118	0.102	0.110	0.103
PGR	Growth rate of product price	0.484	0.492	0.498	0.506	0.471	0.483	0.478	0.493
ENTRATE	Entry rate	0.058	0.052	0.048	0.047	0.094	0.082	0.080	0.071
GRM^{DC}	Growth rate of imports from industrialized countries	0.198	0.170	0.138	0.131	0.312	0.230	0.211	0.183

Table 1 continued

Label	Description	All observations				Entry level observations			
		Domestic	Large domestic	Foreign 10%+	Foreign 50%+	Domestic	Large domestic	Foreign 10%+	Foreign 50%+
GRM^{LDC}	Growth rate of imports from developing countries	0.225	0.196	0.191	0.190	0.262	0.182	0.176	0.125
GRX^{DC}	Growth rate of exports to industrialized countries	0.169	0.144	0.167	0.162	0.207	0.148	0.253	0.205
GRX^{LDC}	Growth rate of exports to developing countries	0.127	0.097	0.137	0.142	0.186	0.102	0.198	0.182
HHI	Herfindahl index	0.050	0.041	0.069	0.064	0.049	0.044	0.065	0.058
MES	Median (log) employment	3.471	3.713	3.730	3.748	3.408	3.693	3.694	3.693
Number of observations (1984-2001)		111161	7973	2849	1870	18278	563	364	264

Note: "Large domestic" plants employ 150 or more employees.

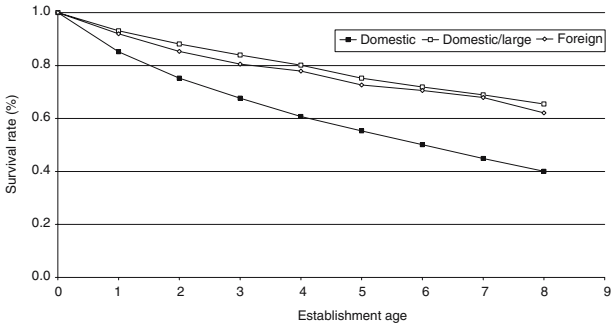

Fig. 2 Survival functions of foreign and domestic plants

result of their prior experience in other countries, the problem of sunk commitment could be less severe for foreign firms than for domestic firms. Second, foreign firms may have relatively stronger financial resources, and better access to external funding, so that financial constraints are less important for foreign firms. The fact that the interest payments/sales ratio is higher for foreign firms indicates that they more easily raise external funding to finance their activities.

Does ownership matter for survival? Figure 2 shows that the survival rates for foreign and domestic plants are different. 60 percent of domestic firms cannot survive until age 8, whereas the same (hazard) rate for foreign plants is only 35 percent.[4] Moreover, large domestic firms' survival rates are comparable to those of foreign firms. This finding points out that firm size could be an important explanatory variable in explaining differences in survival rates. A comprehensive analysis of the factors that determine the survival probability requires the estimation of a formal econometric model, which is discussed in the following section.

4 Determinants of Survival: An Econometric Analysis

4.1 The Model

Our analysis shows that there are substantial (and statistically significant) differences between the survival rates of foreign and domestic firms in Turkish manufacturing industries. In order to test if foreign ownership matters for survival, we estimate a Cox proportional hazards model that defines the probability of exit in a certain time period as a function of a set of time-varying covariates, conditional on surviving until that time period. A functional form has to be assumed for the hazard function in the empirical implementation of the model. The Cox proportional hazards model is used frequently in empirical studies. It assumes a proportional hazards function that is defined by

$$h_{ij}(t) = h_j(t)e^{X_{ijt}\beta}$$

[4] The log rank test rejects the equality of the survival functions at the 5 percent level. As in the case of other variables, the survival rates for minority and majority owned foreign firms are almost the same.

where $h_j(t)$ is the industry-specific baseline hazard function, X is a vector of explanatory variables, and β is a corresponding vector of coefficients. The β parameters are estimated by the maximization of the partial likelihood function that does not require the specification of $h_j(t)$. Subscripts i, j, and t denote "plant", "industry", and "time", respectively.

4.2 The Variables[5]

The dependent variable is the event of an establishment's exit at a particular time t, conditional on that establishment's having survived until that time period. The exit event of those plants that survived until the end of 2001 is not observed; i.e., the distribution of the dependent variable is censored at year 2001. In the estimation of the Cox proportional hazards function, we use two sets of explanatory variables. The first set includes plant-specific variables. The second set includes the data about the characteristics of the sector defined at the 4-digit ISIC level. This specification allows us to infer the plant- and industry-specific characteristics that determine the survival process.

We run separate regressions for domestic and foreign plants, and compare the differences between the determinants of survival. Moreover, we also estimate the baseline hazard rates (the $h_j(t)$ values) for foreign and domestic plants to test if the differences in baseline hazards are statistically significant or not.

Plant-level variables

Almost all empirical studies on survival find that plant size is one of the main determinants of survival (or hazard) probabilities (see, among many other studies, Siegfried and Evans 1994; Mata et al. 1995; Agarwal and Audretsch 2001; Masso et al. 2005; Taymaz 2005). Moreover, Geroski et al. (2003) showed that founding effects, most

[5] The SIS data are used for all variables. The SIS conducts *Annual Surveys of Manufacturing Industries* (ASMI) at private establishments with 10 or more employees and all public establishments. The *Censuses of Industry and Business Establishments*, which cover all establishments, were conducted in 1980, 1985, 1992, and 2002. The data from the 2002 Census were not available at the time of the writing of this paper. For this study we limited the sample for the post 1983 period because the deflators at the sectoral level were not available before 1983. The data, especially on employment and production, have been carefully controlled by the SIS staff during the annual surveys, and the firms were contacted again if inconsistencies were detected. We also checked the data for "outliers" for ratio variables, and outliers were replaced by averages of the previous and next years' values, if the data on these years were available. Otherwise, the outliers were assigned as "missing". On average, the proportion of outliers was less than 2 percent of plant-year observations. The ownership variables (the shares of foreign, private, and public ownership) were checked against unreasonable shifts and missing values. Missing values are "imputed" from the previous and next years' values. The variable that has the highest proportion of missing values was the depreciation allowances variable. The missing values for this variable were imputed from the available data on depreciation allowances in non-missing years of the same plant. If no data were available for a plant (this is usually the case for small plants that survived only a few years), the variable was imputed by using the mean values of the depreciation allowances/number of employees ratio for the relevant sector-size group-year cells. The share of imputed values of depreciation allowances in total depreciation value was about 15 percent. The trade data are also collected by the SIS, and are available at the sectoral level by country of origin and destination country.

importantly entry size, determine exit rates, and in some cases, they are more important that current conditions. Thus, we use entry size (ENTRYLL, the log number of employees at the time of entry) in our model to test the effects of founding conditions on survival.[6] The growth rate of the plant (LGR, the logarithmic growth rate in the number of employees) is also used to check if active learning, as proxied by growth, plays a role in determining the survival probability.

As shown in Siegfried and Evans' survey (1994) and many other recent studies, exit probability is lower where durable specific (sunk) capital costs are more important. Capital intensity (KL) is used to capture the effects of specific capital costs, and it is defined as the (log) capital/labor ratio where "capital" is measured by annual depreciation allowances (deflated by the private sector investment deflator) and "labor" is measured by the number of employees. ADVERINT (the advertising expenditures to sales ratio), SUBINPUT (the share of inputs supplied by explicit subcontractors in all material inputs used by the firm) and SUBOUTPUT (the share of output of a firm supplied directly to a contractor firm)[7] are proxies for product and process characteristics. Advertising will be higher for those products where "brand image" or reputation is important. Moreover, investment in advertising is a sunk cost that cannot be recovered in other activities. Thus, exit will be less likely for advertising-intensive firms. Subcontracting can improve firms' flexibility and reduce exit costs. Thus, SUPINPUT and SUBOUTPUT variables may have a positive impact on hazard rates.

There are four variables about the financial aspects of plants' operations: INTPAY (the ratio of interest payments to sales revenue), PMARGIN (the profit margin, profits before taxes divided by sales revenue), BONUS (the share of non-wage payments in gross wage – i.e., the proportion of bonuses, social contributions, and in-kind payments in gross wage), and LW (the log product wage rate – i.e., the log of gross wage rate divided by the index of product price at the ISIC 4-digit level). *Ceteris paribus*, higher interest payments mean a bigger financial burden on the establishment – i.e., a higher hazard probability. PMARGIN will have the opposite effect because profitable plants are more likely to survive. The wage rate (LW) measures the skill level: higher the skill level, higher the survival probability (Bernard and Jensen 2002). BONUS is more difficult to interpret. Firms may tend to offer higher non-wage payments to boost labor flexibility (by lowering severance payments) and to share risks with their workers. Therefore, higher values of the BONUS variable may be associated with higher hazard probability.

There are a number of other plant characteristics that may have a significant impact on a plant's survival prospects. Most importantly, a new plant could be established by a new firm (in the case of a single-plant firms), or it could be a branch/subsidiary of an existing (multi-plant) firm. As shown, among others, by Audretsch and Mahmood (1994) and Bernard and Jensen (2002), the patterns and probabilities of survival are likely to be different for new branches and subsidiaries established by existing enterprises. Unfortunately, we are not able to link plants in our database to firms/enterprises.

[6] Entry size (ENTRYLL) and current size (LL, the log number of employees) are higly correlated in our sample. It is thus not surprising that the estimation results do not change significantly when current size is used instead of entry size in our model.

[7] If a firm operates as a pure subcontractor, the value of SUBOUTPUT would be equal to 100 percent.

An open-ended question on the name of the "holding company/business group" to which the plant belongs was added into the survey in 1996. We estimated our model for this sub-period (1996-2001) including a dummy variable for members of business groups, and found that plants that are members of business groups are more likely to survive.[8]

Industry-level variables

One of the main hypothesis of the paper states that foreign presence could reduce domestic plants' survival probability because of intensified competition. The market share of foreign firms, FDIMSH, is added to the model to test this hypothesis. A negative impact on survival will be an indication of the competition effect. Moreover, we also use another variable, the growth rate of foreign firms' output (FDIQGR), to test the effects of changes in foreign firms' market share on survival. This variable is expected to have a negative impact on domestic firms' survival prospects (Coucke 2005; Masso et al. 2005).[9]

Exit and entry are strongly correlated, probably due to displacement of incumbents by more efficient entrants (Siegfried and Evans 1994). Thus, the entry rate (ENTRATE, the proportion of employment generated by entrants in the sector) is included in the model to test the displacement hypothesis. An increase in the entry rate will lead to stiffer competition that will eventually reduce the survival probability. QGR and PGR are annual growth rates of real industrial output and output prices.[10] These two variables are related to market prospects and are expected to have a positive impact on survival probability.

A number of studies showed that foreign competition, especially from low-income countries, is a significant determinant of exit (see Bernard and Jensen 2002; De Backer and Sleuwaegen 2003). There are two variables used in our models to test the effects of foreign competition, GRM^{DC} and GRM^{LDC}, growth rates of real imports from the industrialized and developing countries, respectively. We expect that imports from developing countries have a stronger crowding out effect because the products imported from developing countries are likely to be closer substitutes for domestically produced products. The growth rates of exports to industrialized and developing countries, GRX^{DC} and GRX^{LDC}, are also used to test the effects of penetration into foreign markets.

[8] We also tested if technology transfer (a dummy variable that takes value one if the plant transferred technology from abroad through license or know-how agreements), R&D intensity, and exporter status have any impact on survival probabilities (the last two variables were available only since 1990). We found that exporters are more likely to survive, but the coefficients of technology transfer and R&D intensity variables were not statistically significant at the 10 percent level.

[9] In order to avoid the simultaneity bias for foreign plants, these variables are calculated by using the data on "all other plants" in the market. For example, if there is only one foreign plant in a sector whose market share is 10 percent, the value of the FDIMSH variable will be equal to 0.1 for all domestic plants in that market, and zero for the foreign plant. The "industry" (or "market") is defined at the International Standard Industrial Classification (ISIC, Revision 2) 4-digit level.

[10] Real output, imports, and exports are calculated by dividing current values by output prices indices at the ISIC 4-digit level.

Finally, there are two variables included in our models to control for the effects of domestic competition. The degree of concentration is measured by the Herfindahl index (HHI), and the minimum efficient scale, following Alvarez and Görg (2005), is proxied by the sectoral median (log) level of employment (MES). Since the presence of strong incumbents in the markets could make survival more difficult (the competitive pressure argument), we may expect a negative effect of the level of concentration on survival. However, if the oligopolistic firms raise the product price above the competitive level, new firms could find more opportunities to survive in highly concentrated markets. Therefore, the effect of concentration on survival could be ambiguous. It is no surprise that although the level of concentration is found to have a negative impact on survival probability in some studies (Baggs 2005), there are some studies that find no impact at all (for example, see Görg and Strobol 2003a). The MES will have a positive impact on survival if new firms can find niches for themselves in markets where large firms operate (high MES), but find it difficult to compete in markets dominated by similar, small firms (low MES).

4.3 Estimation Results

Cox proportional hazards model estimates are presented in Table 2. All models are stratified by ISIC 2-digit industries so that each industry at the ISIC 2-digit level is permitted to have a different age-dependent baseline hazard function, which is then estimated nonparametrically. All models also include annual dummy variables to take into account the effects of the business cycles and other macroeconomic shocks on survival. All standard errors are clustered on plants. Hazard ratios presented in the table indicate the effect of the variable on hazard probability. A coefficient larger than 1 indicates that the variable increases the hazard (exit) probability, whereas a coefficient smaller than 1 has the opposite effect.

The Cox proportional hazards model imposes the restriction that the hazard functions for different values of the explanatory variables are proportional to each other and their coefficients are constant over time ("plant age" in our case). However, as shown in many studies (for example, Geroski et al. 2003; Disney et al. 2003; Bhattacharjee 2005), the effects of some variables like the size of the firm decline over age. In other words, firm size could have a significant impact on survival probability of only young firms, i.e., size does not matter for old firms. We tested the proportional hazards assumption for each explanatory variable and found that the hypothesis of proportional effect is rejected for a number of variables (namely, the ENTRYLL, KL, QGR, PRGR and ENTRATE variables). Therefore, the age-varying interactions of these variables are added into the model.

We first estimated the model for domestic and foreign firms separately by including only the entry size (ENTRYLL), capital intensity (KL), their interactions with the (log) age (ENTRYLL*LAGE and KL*LAGE), and industry-level variables (see models 1a, 1b, and 1c in Table 2). Capital intensity of a plant is formed mainly by investment made before entry, and it changes gradually over time. In other words, entry size and capital intensity are determined prior to entry, and are not affected by a plant's post-entry performance. However, other plant-level variables are likely to be affected by a plant's

performance and business strategies. For example, foreign firms are, on average, more productive and profitable, and they may not need to operate as subcontractors for other firms. Therefore, the model with only entry size, capital intensity, and industry-level variables will not have any endogeneity problem that may lead to underestimation of the effects of foreign ownership.

The estimation results for domestic and foreign firms (Models 1a and 1b, respectively) are quite similar. We also estimated the same model by pooling all observations together (Model 1c),[11] and used the log likelihood ratio test to check if the samples for domestic and foreign plants can be pooled together. The log likelihood ratio (LLR) test statistics (distributed as a Chi-square statistic with 33 degrees of freedom, the last row in Table 2) does not reject the null hypothesis that the coefficients of the covariates are basically the same.[12]

The baseline hazard rates are estimated nonparametrically for domestic and foreign firms (Figure 3). The hazard rates are quite high in the first two years (more than 15 percent) and rapidly decline to about 6–7 percent after age 5. There seems to be no significant difference between domestic and foreign plants, and the stratified log rank test does not reject the equality of baseline hazard functions at the 5 percent level.[13] Thus, we conclude that the data on Turkish manufacturing industries provide no evidence for the hypothesis that foreign plants have higher survival probabilities.

The effects of foreign presence in the market are tested by two variables: the market share of foreign plants (FDIMSH), and the growth rate of output produced by foreign plants (FDIQGR). The hazard rate for the FDIMSH variable is greater than one in all models – i.e., the hazard rate is increased by foreign presence in the market – but it is not statistically significant at conventional levels. Foreign plants make life for others neither more difficult (through stiff competition), nor easier (through spillovers). The hazard rate for the growth rate of foreign plants' output (FDIQGR) is also greater than one, but it becomes statistically significant at the 5 percent level only for domestic plants when plant-level variables are included in the model. Note that this is a temporary effect: an *increase* in the market share of foreign plants is likely to eliminate some domestic plants in the short run. Thus, our estimation results provide only weak support for the hypothesis that foreign plants have a temporary competitive effect on domestic plants.

Regarding other variables, all models offer similar results: plant size (both at the time of entry and current year) is an important determinant of survival. However, its effect declines over time and becomes insignificant at about age 20–25. Plant size seems to have a slightly smaller effect for foreign firms. Capital intensity also plays an important role.[14] Exit is slower for capital intensive plants. Interestingly, the

[11] In this case, the Cox proportional hazards model is stratified by ISIC 2-digit industries and foreign ownership status to allow for different baseline hazard functions for domestic and foreign plants.

[12] The test results do not change when plant-level variables are included (see model 2).

[13] The stratified log rank test rejects the equality of survival functions at the 6.6 percent level.

[14] The value of depreciation allowances is used as a proxy for the "capital" variable because it represents, theoretically, the services of capital. Since the value of depreciation allowances are driven by accounting regulations, we experimented with two alternatives measures for the capital variable: the real value of fixed assets and the total power (in horse power) of all machinery and equipment installed in the plant. There are substantial numbers of observations with missing fixed assets values (about one third of all, including all those plants employing 10–24 people in the period 1983–1992). The missing values were imputed by using

Table 2 Cox proportional hazards model estimation results

	Model 1a		Model 1b		Model 1c		Model 2a		Model 2b		Model 2c	
	Domestic plants		Foreign plants		All plants		Domestic plants		Foreign plants		All plants	
	Haz. rate	Std err	Haz. rate	Std err	Haz. rate	Std err	Haz. rate	Std err	Haz. rate	Std err	Haz. rate	Std err
Entry size, and capital intensity variables												
ENTRYLL	0.556	0.018**	0.651	0.128**	0.558	0.018**	0.504	0.018**	0.697	0.151*	0.507	0.018**
ENTRYLL*LAGE	1.201	0.023**	1.142	0.148	1.200	0.023**	1.256	0.027**	1.089	0.152	1.254	0.027**
KL	0.957	0.011**	0.687	0.074**	0.953	0.011**	0.987	0.012	0.741	0.088**	0.985	0.012
KL*LAGE	0.933	0.007**	1.058	0.077	0.935	0.007**	0.931	0.007**	1.065	0.104	0.932	0.007**
Industry-level variables												
FDIMSH	1.008	0.092	2.151	1.487	1.023	0.093	1.076	0.104	2.676	1.965	1.097	0.105
FDIQGR	1.032	0.021	1.080	0.284	1.032	0.020	1.046	0.022**	1.211	0.349	1.047	0.022**
QGR	0.897	0.120	1.068	1.010	0.905	0.119	0.972	0.133	0.779	0.739	0.982	0.133
QGR*LAGE	1.101	0.093	0.585	0.397	1.089	0.091	1.108	0.097	0.538	0.394	1.091	0.095
PRGR	1.158	0.211	0.224	0.454	1.148	0.208	1.050	0.197	0.102	0.215	1.030	0.193
PRGR*LAGE	0.734	0.070**	2.920	2.858	0.741	0.070**	0.788	0.078**	3.964	3.912	0.799	0.079**
ENTRATE	1.850	0.918	4.297	19.383**	2.095	1.026	5.827	3.261 **	6.812	35.736**	6.794	3.746**
ENTRATE*LAGE	0.481	0.159**	1.468	7.317*	0.449	0.147**	0.289	0.112**	0.307	1.901*	0.263	0.101**
GRM^{DC}	1.050	0.036	1.098	0.375	1.050	0.035	1.050	0.038	1.350	0.464	1.052	0.038
GRM^{LDC}	1.020	0.015	0.855	0.102	1.018	0.015	1.030	0.016 *	0.778	0.106*	1.028	0.016*
GRX^{DC}	0.946	0.021**	0.714	0.148*	0.943	0.021**	0.937	0.022**	0.685	0.125**	0.934	0.022**
GRX^{LDC}	1.016	0.023	1.083	0.253	1.019	0.023	1.026	0.024	1.071	0.246	1.027	0.024
HHI	1.628	0.423*	18.303	30.548*	1.695	0.437**	1.310	0.367	38.315	62.983**	1.403	0.392
MES	0.918	0.041*	0.539	0.180*	0.913	0.040**	0.902	0.044 **	0.470	0.167**	0.899	0.043**

Table 2 continued

	Model 1a		Model 1b		Model 1c		Model 2a		Model 2b		Model 2c	
	Domestic plants		Foreign plants		All plants		Domestic plants		Foreign plants		All plants	
	Haz. rate	Std err	Haz. rate	Std err	Haz. rate	Std err	Haz. rate	Std err	Haz. rate	Std err	Haz. rate	Std err
Plant-level variables												
LGR							0.385	0.013**	0.572	0.157**	0.386	0.013**
ADVERINT							0.039	0.067*	10.721	61.984	0.048	0.078*
SUBINPUT							0.932	0.096	11.201	8.851**	0.959	0.097
SUBOUTPUT							1.350	0.061**	0.658	0.427	1.342	0.061**
INTPAY							4.332	1.484**	0.432	1.315	4.109	1.398**
PMARGIN							0.896	0.063	0.848	0.527	0.894	0.063
BONUS							3.598	0.781**	1.345	1.816	3.508	0.749**
LW							0.674	0.018**	0.707	0.134*	0.675	0.018**
# observations	69339		2020		71359		65841		1917		67758	
# plants	14902		437		15162		14468		420		14719	
# exits	7953		112		8065		6977		99		7076	
Wald test (Chi-square)	1768**		149**		1822**		2771**		157**		2837	
Log likelihood	−54429		−343		−54791		−46918		−290		−47231	
LLR test (DoF)					37.7 (33)						46.5 (41)	

** (*) means statistically significant at 5% (10%) level. Robust standard errors are calculated, and clustered on plants.
All models are stratified by ISIC 2-digit industries and foreign ownership status, and include time dummy variables.

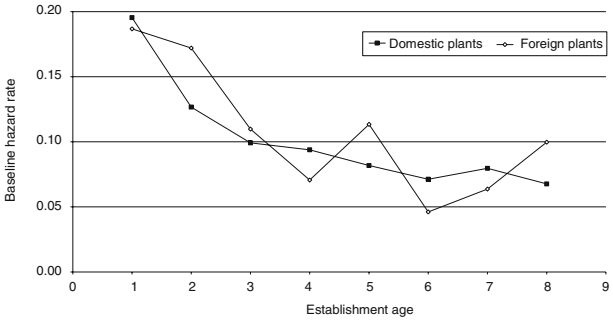

Fig. 3 Baseline hazard rates for foreign and domestic plants

importance of capital intensity seems to be increasing over time, possibly as a result of accumulation of sunk commitments. The entry rate facilitates exit as a result of the competition effect.

Imports from industrialized countries do not have a significant impact on exit, but imports from developing countries have opposite effects on domestic and foreign plants. Domestic plants are negatively affected by an increase in imports from developing countries, but foreign plants seem to benefit developing countries' exports to Turkey, although these effects are statistically significant at only a 10 percent level. As may be expected, growing exports to the industrialized countries enhance the prospects for survival, whereas exports to developing countries have no significant impact.

The degree of concentration increases the hazard probability. Interestingly, foreign plants are more sensitive to concentration than are domestic plants. Plants entering the industries that are characterized by higher minimum efficient scale have lower exit rates.

Among the plant-level variables, only the wage rate and employment growth have statistically significant coefficients for both domestic and foreign plants. Plants that employ skilled workers, pay higher wages, and grow rapidly, survive longer. Profit margin does not have any impact on survival of domestic and foreign plants. Domestic plants that work as subcontractors for other firms, have higher interest expenses, and pay more bonus-type payments for labor are more likely to exit. Interestingly, the use of subcontracted inputs has a detrimental impact on foreign plants.

Footnote 14 continued
industry-size-year averages of fixed assets/power ratios. When the fixed assets variable was used as a proxy for capital, the coefficient of the capital/labor ratio became insignificant for foreign plants (models 1b and 2b). When the power variable was used, the coefficient of the KL*LAGE interaction variable became larger than 1, and statistically significant at the 5 percent level in all models. This result implies that the effect of capital/labor ratio on survival diminishes by age. There was not any qualitative change in other estimates. These findings show that estimation results are robust to the choice of the capital variable.

5 Conclusions

In this paper, we analyzed the impact of foreign direct investment (FDI) on entry and selection (exit) processes. There are three main conclusions derived from our analysis on foreign and domestic plants in Turkish manufacturing industry for the period 1983–2001:

First, there are significant differences between entry characteristics of foreign and domestic plants. Most importantly, foreign entrants are almost three times larger than are domestic entrants. At the time of entry, foreign plants use more capital intensive technologies, pay higher wages, have better access to external sources of funding, and are more profitable than are domestic plants.

Second, entry-level differences persist after entry, and foreign plants are more likely to survive. In other words, a large proportion of domestic plants exit in a few years, whereas the exit rate is much lower for foreign plants.

Third, although foreign plants are less likely to exit, neither foreign ownership itself nor foreign presence in the market matter for survival. What matters is the other industry and other plant characteristics such as the size of the plant, capital intensity, growth rate, quality of the labor force, etc. In other words, foreign plants are less likely to exit not because of foreign ownership, but because of their (initial) size advantages and other characteristics.

Since foreign ownership and the presence of foreign firms in the market do not have any significant impact on the survival of domestic (and foreign) firms, there is no need to fear that foreign firms impose undue pressures on domestic firms. Similarly, there is no need to expect positive gains from FDI in the form of better passive learning. In other words, the country's industrial policy should be ownership-neutral.

We found that there are considerable differences between entry characteristics of foreign and domestic firms, these differences are persistent, and they determine the post-entry performance and survival probability. Therefore, industrial policy should aim at influencing entry characteristics through focusing on the training of entrepreneurs, providing managerial and technical information, facilitating technology transfer, and providing initial financial support in the form of seed and venture capital.

Acknowledgements We would like to thank two anonymous referees and Lawrence J. White for their extremely helpful comments and suggestions. This work has benefited from a financial grant from the Economic Research Forum. The contents and recommendations do not necessarily reflect the views of the Economic Research Forum.

References

Agarwal, R., & Audretsch, D. B. (2001). Does entry size matter? The impact of the life cycle and technology on firm survival. *Journal of Industrial Economics, 49*, 21–43.

Alvarez, R., & Görg, H. (2005). Multinationals and plant exit: Evidence from Chile. Institute for the Study of Labor (IZA) Discussion Paper No. 1611, Bonn.

Audretsch, D. B., & Mahmood, T. (1994). The rate of hazard confronting new firms and plants in U.S. manufacturing. *Review of Industrial Organization, 9*, 41–56.

Audretsch, D. B. & Siegfried, J. J. (Eds.) (1992). Empirical studies in industrial organization: Essays in honor of Leonard W. Weiss. Dordrecht, Boston: Kluwer Academic Publishers.

Baggs, J. (2005). Firm survival and exit in response to trade liberalization. *Canadian Journal of Economics, 38*, 1364–1383.
Bellak, C. (2004). How domestic and foreign firms differ and why does it matter? *Journal of Economic Surveys, 18*, 483–514.
Bernard, A. B., & Jensen, J. B. (2002). The deaths of manufacturing plants. NBER Working Paper No. 9026, Cambridge, MA.
Bernard, A. B., & Sjöholm, F. (2003). Foreign owners and plant survival. NBER Working Paper No: 10039, Cambridge, MA.
Bhattacharjee, A. (2005). Models of firm dynamics and the hazard rate of exits: Reconciling theory and evidence using hazard regression models. CRIEFF Discussion Paper Number 0502, University of St. Andrews, St. Salvator's College, St. Andrews.
Blomström, M., & Kokko, A. (1998). The impact of foreign investment on host countries: A review of the empirical evidence. *Journal of Economic Surveys, 12*, 247–277.
Blomström, M., & Sjöholm, F. (1999). Technology transfer and spillovers: Does local participation with multinationals matter? *European Economic Review, 43*, 915–923.
Caves, R. (1974). Multinational firms, competition and productivity in host country markets. *Economica, 41*, 176–193.
Caves, R. E. (1998). Industrial organization and new findings on the turnover and mobility of firms. *Journal of Economic Literature, 36*, 1947–1982.
Coucke, K. (2005). Import competition and exit of firms in Belgian manufacturing, Vlerick Leuven Gent Working Paper 2005/14, Vlerick Leuven Gent Management School, Leuven.
De Backer, K., & Sleuwaegen, L. (2003). Does foreign direct investment crowd out domestic entrepreneurship? *Review of Industrial Organization, 22*, 67–84.
Disney, R., Haskel, J., & Heden, Y. (2003). Entry, exit and establishment survival in UK manufacturing. *Journal of Industrial Economics, 51*, 91–112.
Dutz, M., Us, M., & Yılmaz, K. (2005). Foreign direct investment challenges: Competition, the rule of law, and EU accession. In B. Hoekman, & S. Togan (Eds.), Turkey: Economic reform and accession to the European Union (pp. 261–293). Washington, DC: The World Bank, & CEPR.
Erdilek, A. (1986). Turkey's new open-door policy of direct foreign investment: A critical analysis of problems and prospects. *METU Studies in Development, 13*, 171–191.
Ericson, R., & Pakes, A. (1995). Markov-perfect industry dynamics: A framework for empirical work. *Review of Economic Studies, 62*, 83–82.
Findlay, C., & Warren, T. (2000). *Impediments to trade in services: Measurement and policy implications*. London: Routledge.
Geroski, P. A. (1995). What do we know about entry? *International Journal of Industrial Organization, 13*, 421–440.
Geroski, P. A., Mata, J., & Portugal, P. (2003). Founding conditions and the survival of new firms. Banco de Portugal Economic Research Department Working Paper No: 1–03, Lisbon.
Gibson, J. K., & Harris, R. I. D. (1996). Trade liberalisation and plant exit in New Zealand manufacturing. *Review of Economics and Statistics, 78*, 521–529.
Girma, S., & Görg, H. (2001). Blessing or curse? Domestic plants' survival and employment prospects after foreign acquisition. Stockholm School of Economics, The European Institute of Japanese Studies Working Paper No.130, Stockholm.
Görg, H., & Strobl, E. (2001). Multinational companies and productivity spillovers: A meta-analysis. *Economic Journal, 111*, 723–739.
Görg, H., & Strobl, E. (2003a). Multinational companies, technology spillovers, and plant survival. *Scandinavian Journal of Economics, 105*, 581–595.
Görg, H., & Strobl, E. (2003b). Footloose multinationals? *Manchester School, 71*, 1–19.
Hopenhayn, H. A. (1992). Entry, exit, and firm dynamics in long run equilibrium. *Econometrica, 60*, 1127–1150.
Jovanovic, B. (1982). Selection and the evolution of industry. *Econometrica, 50*, 649–670.
Kimura, F., & Kiyota, K. (2007). Foreign-owned versus domestically-owned firms: Economic performance in Japan. *Review of Development Economics, 11*, 31–48.
Lenger, A., & Taymaz, E. (2006). To innovate or to transfer? A study on spillovers and foreign firms in Turkey. *Journal of Evolutionary Economics, 16*, 137–153.
Li, J., & Guisinger, S. (1991). Comparative business failures of foreign-controlled firms in the United States. *Journal of International Business Studies, 22*, 209–224.

Masso, J., Eamets, R., & Philips, K. (2005). Creative destruction and transition: The effects of firm entry and exit on productivity growth in Estonia. Retrieved August 22, 2006, from Rovira i Virgili University, Faculty of Economics and Business Studies Web site: http://www.fcee.urv.es/departaments/economia/recerca/grit/Catala/web/papers/Paper%20Masso-Eamets-Philips%20311005.pdf

Mata, J., Portugal, P., & Guimarães, P. (1995). The survival of new plants: Start-up conditions and post-entry evolution. *International Journal of Industrial Organization, 13*, 459–481.

Mata, J., & Portugal, P. (2002). The survival of new domestic and foreign owned firms. *Strategic Management Journal, 23*, 323–343.

Nelson, R. R., & Winter, S. G. (1982). *An evolutionary theory of economic change*. Cambridge, Mass: The Belknap Press.

Öniş, Z. (1994). Liberalization, transnational corporations and foreign direct investment in Turkey: The experience of the 1980s. In Ş. Fikret (Ed.), *Recent industrialization experience of Turkey in a global context* (pp. 91–109). Westport, Connecticut and London: Greenwood Press.

Pérez, S. E., Llopis, A. S., & Llopis, J. A. S. (2004). The determinants of survival of Spanish manufacturing firms. *Review of Industrial Organization, 25*, 251–273.

Siegfried, J. J., & Evans, L. B. (1994). Empirical studies of entry and exit: A survey of the evidence. *Review of Industrial Organization, 9*, 121–155.

Söderbom, M., Teal, F., & Harding, A. (2006). The determinants of survival among African manufacturing firms. *Economic Development and Cultural Change, 54*, 533–555.

Taymaz, E. (2005). Are small firms really less productive? An analysis of productivity differentials and firm dynamics. *Small Business Economics, 25*, 429–445.