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Abstract: Foreign direct investment has been considered for a long time as an important channel for transfer of technology to developing countries, and an important tool to generate jobs in those countries. Multinationals bring the factor that developing countries need most, capital, and therefore, they may also help to ease the unemployment pressure created by a rapidly growing (urban) population. It is shown by many researchers that foreign establishments are much more productive than domestic firms, but the empirical evidence regarding technology 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 establishments, i.e., entry, selection (exit), and growth processes. Our analysis on foreign and domestic establishments in Turkish manufacturing industry for the period 1983-96 indicates that foreign establishments have a better performance level than domestic ones when they are first established in the local market, and have a higher survival probability. However, when the establishment characteristics are controlled for, domestic establishments have the same survival probability, but achieve lower rates of employment growth in the early post-entry period.

Keywords: FDI, firm dynamics, survival, growth, Turkish manufacturing industries

1. Introduction

The post-war period saw a rapid increase in international economic activities and, most importantly, in foreign direct investment (FDI) in developing countries. The rise in FDI has attracted the attention of industrial and developments economists especially since the late 1960s. FDI has been considered by many development economists as an important channel for transfer of technology to developing countries, and an important tool to generate jobs in those countries. It is suggested that modern, advanced technologies introduced by multinational firms diffuse to domestic firms through spillovers (imitation, demonstration effects, training local labor, vertical technology transfers, etc.). As a result of technology spillovers and competitive pressures, the productivity and international competitiveness of domestic firms could be enhanced. Moreover, multinationals bring the factor that developing countries need most, capital, and therefore, they may also help to ease the unemployment pressure created by a rapidly growing (urban) population.

This literature is focused mainly on two topics: the determinants of FDI, and the impact of foreign firms on local industry. The researchers that established firmly the field (for example Vernon, 1966; Caves, 1974; Dunning, 1977) suggested that there are various (in some cases substitute) ways available for a (multinational) firm to serve foreign markets: FDI, exports, and licensing. The choice between FDI and other alternatives depends on a number of firm (ownership), location and internalization advantages. As Markusen and Maskus (2000) show neatly, the multinational firms' investment behavior can be captured in a "knowledge capital" model. The multinational firm who has a technological superiority may prefer FDI over other alternatives to prevent the dissipation of knowledge based assets. Thus, multinational firms are expected to have a technological advantage over domestic firms because they would not go abroad where they are less familiar with market conditions.[1]

There are various empirical studies that document technological superiority of foreign over domestic firms in a number of developing countries. This is indeed the case even in developed countries. For example, using plant level US data, Doms and Jensen (1998), and Blonigen and Tomlin (2001) show that there are substantial size and/or labor productivity differences between US-owned and foreign plants. Griffith (1999), Griffith and Simpson (2001) and

[1] For comprehensive surveys on the role of FDI and trade in technology transfer and spillovers, see Markusen (1998 and 2000), Blomström and Kokko (1998 and 2001), Saggi (2000), and Keller (2001).

Harris and Robinson (2001) observe similar differences for Canada and Britain/UK, respectively. Although productivity differences between foreign and domestic plants could be explained by other factors like plant size, capital intensity, etc., it is one of the most robust empirical finding 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 benefit for the host economy. Therefore, researchers search for spillovers from foreign to domestic firms. Early studies using industry-level data almost unanimously found a positive correlation between the presence of FDI (usually measured by the share of foreign firms) and industry (labor) productivity (see, for example, Caves, 1974; Blomström and Sjöholm, 1999, Liu *et al*., 2000). However, industry-level studies may suffer from some specification problems, including the endogeneity bias, i.e., the positive correlation may also arise if technologically advanced/ productive sectors are more attractive for foreign investment.

Thanks to the availability of longitudinal firm/plant data, recent studies explore spillovers at the firm/plant level. In an early study using plant level data, Haddad and Harrison (1993) find in Morocco that there was a level effect of FDI on the total factor productivity (TFP) of domestic firms, but not a growth effect. Aitken and Harrison (1999) and Djankov and Hoekman (2000) find even negative effects of FDI on the productivity of domestic firms in Venezuelan and Czech industries, respectively, whereas Kinoshita (2001) suggests that technology spillovers from FDI occur in Czech manufacturing industries for firms that are R&D intensive. Blomström and Sjöholm (1999) find positive spillovers in Indonesia, but the degree of foreign ownership does not affect the degree of spillovers. Kokko, Tansini and Zejan (2001) find in the case of Uruguay that spillovers (positive impact on labor productivity of local firms) emanate only from older import-substituting multinational firms that were established before 1973. The presence of spillovers is also an issue for developed countries. In a recent study on Japanese FDI in the US, Branstetter (2000) find evidence that FDI increases the flow of knowledge spillovers both from and to the investing Japanese firms.

Since spillovers from FDI can also be observed in higher wages, many researchers have analyzed the effect of the presence of foreign-owned firms on wages, see, for example, Aitken, Harrison and Lipsey (1996) for Mexico, Venezuela, and the US; Figlio and Blonigen (1999) for the US; and Lipsey and Sjoholm (2001) for Indonesia. A robust finding of these

studies is the stylized fact that foreign firms pay a higher wage, but the effect on wages paid by domestic firms is not strong.[2]

To summarize, although foreign firms are larger, more productive and more capital and skill intensive than their domestic counterparts in both developed and developing countries, their effects on domestic firms and the strength of spillovers are not unambiguous. The findings of empirical studies lead researchers to conclude that the characteristics of the host country's industry and policy environment (Blomström and Kokko, 1998), the level of human capital stock (Borensztein, Gregorio and Lee, 1995; Noorbaksh, Paloni and Youssef, 2001), and absorptive capacity of domestic firms (Kinoshita, 2001) are important determinants of the net benefits of FDI.[3]

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 dynamics of competition. However, we believe that the dynamics of competition is indeed the missing link crucial for our understanding of 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 productivity of domestic firms through spillovers, and/or by exerting competitive pressure on local firms, and forcing them to be more productive (Blomström and Kokko, 1998). Therefore, the existence of a 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. In a similar way, the superiority of multinationals in terms of size, productivity, wages, export orientation, etc., cannot be explained by the argument that "to become a viable multinational a firm must have outperformed domestic and foreign rivals in some dimension" (Hanson, 2001), because there is not much evidence that proves that multinationals are more *viable* than domestic firms. The evidence provided on the superiority of foreign firms does not indicate i) if it merely reflects superior *entry characteristics* of foreign firms that they first secured in their home markets, or ii) if it is accomplished by a *learning process* in the host economy, or iii) if it is a simple outcome of the competitive processes that *rapidly eliminate inefficient foreign firms* that have lower exit

[2] There is also a growing literature on export spillovers generated by FDI. See, for example, Aitken, Hanson and Harrison (1997) and references therein.

[3] Although the evidence on positive spillovers from FDI is weak, many developing country governments have adopted FDI promotion policies (for policy issues, see Markusen, 1998; Hanson, 2001).

costs that domestic firms. Moreover, the effect of FDI on domestic firms cannot be well-understood without any information on how foreign firms are established, and how they survive and grow, because their impact on domestic firms is determined by these competitive processes they are surrounded with.

The aim of this paper is then three-fold: to analyze i) differences in *entry characteristics* of foreign and local firms, ii) differences in *post-entry performances* of foreign and domestic firms, and iii) differences in *learning behaviors* (active and/or passive) of foreign and domestic firms in Turkish manufacturing industries. We hope that the analysis of the competition process will enhance our understanding of the exact nature of the relation between foreign firms and the host economies.

This paper contributes the existing literature by presenting new evidence on entry, exit, and growth patterns of domestic and foreign establishments in the context of 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 describes policy framework and inward-FDI flows in Turkey since 1980. A descriptive analysis of entry-level characteristics and survival rates of foreign and domestic plants in Turkish manufacturing industries is presented in the same section. The estimation results of an econometric analysis of survival and growth processes are discussed in Section 4. Major findings and policy implications are summarized in Section 5.

2. Dynamics of firms and ownership: Hypotheses

Although research on the dynamics of firms has a long tradition that dates back even to the classical economists, the increased availability of panel data on firms/establishments in the last couple of decades has sparked a large number of both empirical and theoretical studies on this topic. 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" which 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 Geroski, 1995; Sutton, 1997; 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 it is common, observed in all countries and sectors. Moreover, entrants start small: new firms are usually smaller than incumbents when they start. This also implies that entrants start out their life with a relatively low level of investment 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, entry process is surrounded with uncertainty: entrepreneurs may not exactly know how well they will perform in the market. It may be rational to start out small to limit sunk commitments even if it imposes a cost penalty, and tend to invest more and grow after gathering information on its (potential) performance. Second, new firms may start out small because of (capital) market imperfections. Even a confident entrepreneur may start out with a small firm if asymmetric information and capital market imperfections make it difficult to raise capital (the liquidity constraint).

If uncertainty and capital market imperfections are important, then one may expect differences between entry characteristics of single plant and multi plant firms because, a multi plant firm is likely to have better information on its capabilities, and, as an established firm, to have less problems in raising capital for its new investment. Empirical studies, indeed, provide strong evidence for this hypothesis. For example, Dunne, Roberts and Samuelson (1988) show that the initial size of multi plant entrants (diversifying firm) is much higher than that of single plant entrants. A similar effect could be expected for domestic and foreign firms. 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 they may have a better reputation with financial institutions. Thus, the first hypothesis can be formulated as follows:

Hypothesis 1. Initial (entry) size of foreign establishments is larger than that of domestic establishments.

Most new entrants are small and they never overcome the competitive pressures: entrants suffer from high mortality rate, and there seems to be a strong positive correlation between entry size and the survival probability. However, as in many other aspects of firm dynamics, 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, 2001b). In other words, foreign firms may have lower exit cost that makes 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.

Hypothesis 2. Foreign establishments will have lower survival probability if they are footloose, or higher survival probability if they have better pre-entry assessment of the market conditions.

There are a large number of studies that analyze the factors that determine the survival probability of foreign firms (for example, see Li, 1995; Barkema, Bell and Pennings, 1996; Shaver, Mitchell and Yeung, 1997; Yamawaki, 1997 and 1999; McCloughan and Stone, 1998; Pan and Chi, 1999; Delios and Beamish, 2001). These studies usually use binominal explanatory variables (survived/exited), and test the effects of entry mode (new plants/acquisition), degree of foreign ownership (joint venture/wholly owned), and other factors on survival probability. The main shortcoming of these studies is the lack of comparable data on domestic establishments because they use data on only foreign firms/subsidiaries. Therefore, they do not directly compare survival patterns of foreign and domestic establishments.

There are only a few studies that use panel data on both domestic and foreign establishments, and the findings are ambiguous. For example, Gibson and Harris (1996) have found that foreign firms are less likely to exit in New Zealand manufacturing industry, whereas Görg and Strobl (2001b) had an opposite result: foreign firms are more likely to exit in Irish manufacturing. 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) have found in Portugal that domestic and foreign firms do not exhibit different survival probabilities.

Active learning models suggest that post-entry performance has a very significant impact on survival probability. An establishment that is not currently profitable (as a result of small initial size and/or low initial productivity) may continue to operate in the market if it has better prospects in the future. Therefore, a high growth establishment may have a higher survival probability. This learning effect could be equally important for both domestic and foreign establishments. Hence,

Hypothesis 3. Active learning (as measured by employment growth rates) has the same effect on survival probability of domestic and foreign establishments.

The presence of foreign establishments will change competitive conditions in the market. Foreign establishments are likely to intensify competition, and may force domestic establishments go out of the market (Caves, 1974; Blomström and Sjöholm, 1998). This has, of course, efficiency improving effect because the least efficient domestic establishments tend to exit first. However, domestic firms may benefit from spillovers from foreign establishments, 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. The net effect of foreign firms on domestic establishments' survival depends on the host country's policy environment, and the technological capacity of domestic firms. For example, Agosin and Mayer (2000) has found that there has been a strong crowding in of domestic investment by FDI in Asia, but strong crowding out has been the norm in Latin America. Görg and Strobl (2001a) have found in Ireland that the presence of foreign firms has a life enhancing effect on domestic establishments in high technology sectors only. In our context, we expect that the competitive effect will be dominant because domestic firms' R&D expenditures are very low.

Hypothesis 4. The foreign presence will 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 foreign presence may generate positive information externalities for foreign entrants. Shaver, Mitchell

and Yeung (1997) suggest that foreign firms will be more likely to survive the greater the foreign presence in the target industry if the entrant has an experience in another industry in the host country. Our data do not allow us to identify the presence of a firm in different industries. Therefore, we formulate the hypothesis in a weaker form.

Hypothesis 5. The foreign presence may enhance foreign establishments' survival probability.

"Gibrat's Law" is one of the most influential and controversial argument on firm growth. It states that growth rates of firms are independent of their sizes. The original formulation of Gibrat's Law ignores the processes of entry and exit, and their impact on firm growth. However, empirical studies provide ample evidence that although the survival rate of entrants is low, those who survive achieve very high growth rates, leading to a negative correlation between size and growth among surviving firms (for early studies, see Evans, 1987 a and 1987b; Hall, 1987. For a recent study on the growth rate of Japanese manufacturing plants in the US, see Blonigen and Tomlin, 2001). This finding is consistent with learning and real options theory. If new firms start at small scale because they are uncertain about their ability and/or they lack resources, those who prove to be efficient and profitable will survive, establish a reputation, and grow faster by investing internal resources or by lending. If this is the case, then the current size of the establishment will be negatively correlated with the current growth rate. This negative correlation, however, will be less significant for foreign establishments because the uncertainty and liquidity constraints are less severe for foreign than domestic firms.

Hypothesis 6. The impact of the current size on growth rate will be smaller for foreign establishments.

Although foreign firms may own superior technological and managerial expertise, they operate in a different environment, and face different types of learning challenges. As they operate in the domestic market, they gradually increase their output if they are more efficient. Thus, independent of its current size, foreign establishments tend to grow faster than domestic establishments.

Hypothesis 7. Foreign establishments have higher growth rate than domestic establishments.

These hypotheses summarize the expected behavioral differences between domestic and foreign establishments in Turkish manufacturing industries. After a brief description of policy environment and FDI flows in Turkey in the 1980s and 1990s in the following section, we will test these hypotheses by using establishment level panel data for Turkish manufacturing industries for the period 1983 to 1996 (sections 3 and 4).

3. Foreign direct investment in Turkey

The first legislation in Turkey governing the foreign investments was introduced in the early 1950s. The Foreign Capital Law which was enacted in 1954 and the related Decree of the Council of Ministers had remained in force since the late 1980s. The Law and the Decree provided a quite liberal framework of general principles designed to create a favorable environment for FDI. However, it is suggested by some researchers that the government institutions, and most importantly the State Planning Organization, who were suspicious of foreign capital, had effectively kept inward foreign investment at low levels with various restrictive bureaucratic practices (Erdilek, 1982). Thus, the *cumulative* total of FDI authorized from 1950 to 1980 had reached only 229 million USD (Öniş, 1994).

The import substitution industrialization strategy followed by the Turkish governments in the 1960s and 1970s had to be abandoned as a result of a severe balance of payments crisis in the late 1970s. On January 24, 1980, the Turkish government announced a stabilization program that was fully implemented under the military regime after September 1980. The new program was based on outward-oriented trade strategy and foreign trade, product, and, later, capital markets have been liberalized to a large extent (for a comprehensive overview of the Turkish economy, see Kepenek and Tentürk, 2000).

The administrative system regulating FDI was reorganized in the early 1980s to simplify investment procedures and to eliminate ambiguities arising from the fragmented bureaucratic structure. Moreover, all discriminatory treatment foreign investor were subject to and conditions on local equity participation were gradually eliminated (Erdilek, 1986; Akpınar, 2001). The complete liberalization of capital accounts in 1989 provided an additional impetus for foreign investment. As a result, the number of firms with foreign participation increased

from 78 in 1980 to 1,856 in 1990 and to 5,328 in 2000, whereas total value of inflow of FDI reached 2.6 billion USD in the 1980-89 period and 11.8 billion USD in the 1990-2000 period.[4] The manufacturing industry alone accounted for 55% of cumulative authorized FDI in the post-1980 period.[5]

The annual FDI has been about one billion USD in the 1990s. Many analysts claim that Turkey is under-performing relative to Central and East European Countries and other countries at the same level of development in attracting FDI (see, for example, Loewendahl and Ertugal-Loewendahl, 2000). However, an analysis of foreign firms' share in Turkish manufacturing employment and value added suggests that FDI plays a substantial role in Turkish manufacturing industries.

The share of foreign firms[6] in total number of private firms in the manufacturing industry was about 2.3 % in 1983, but it increased continuously up to 4.8 % in 1994 through acquisitions and entry.[7] There is a slight decline in the share in 1995 and 1996 that was caused by a rapid increase in the number of domestic firms (Figure 1).

The share of foreign firms in private manufacturing employment was about 8.6 % with 45 thousands people employed by foreign firms. Employment share of foreign firms increased gradually, especially after 1988, and reached 14.4 % in 1992. The number of employees in foreign firms dropped about 5 % from 1993 to 1996, but domestic firms secured more than 20% increase that led to a decrease in the employment share of foreign firms in 1995 and 1996.

The share of foreign firms in the capital stock of the Turkish private manufacturing industry has followed a pattern similar to the employment share in the 1980s and 1990s, but it has been

[4] For the data on inward FDI and the list of all firms with foreign equity participation, see the web site of the Undersecretariat of Treasury (http://www.hazine.gov.tr).

[5] The share of the manufacturing industry in total FDI was about 88% in 1977 (Öniş, 1994: 9).

[6] Following the usual convention, "foreign firms" are defined as those joint vetures where foreign ownership is 10 % or more. If the foreign share is less than 10 %, it is considered to be portfolio investment. Joint ventures with more than 50% (90 %) foreign ownership are "majority-owned foreign firms" ("wholly-owned foerign firms").

[7] The data refers to all *private* establishments employing 25 or more people. The data source is the State Institute of Statistics (SIS) Longitudinal Database that includes all public and private establishments employing 10 or more people. Since the data for ownership are not available for "small" (those employing 10-24 people) establishments for the whole period, they are not covered in our study. The statistical unit is the "establishment" which is the main decision-making unit. Most of the firms in Turkish manufacturing inddustries own only one establishment.

considerably higher than the employment share because foreign firms tend to use more capital-intensive technologies. The share of foreign firms in capita stock was about 15 % in 1983, but it exceeded 20 % in the early 1990s, followed by a few percentage points decline in the mid-1990s.

Foreign firms are on average more productive than domestic firms. Consequently, their share in manufacturing value added is quite substantial. They produced about 15 % of value added in 1983, and increased their share continuously until 1993 (29 %). As observed in other variables, the value added share decreased slightly in 1994-96. Although the value added share of majority-owned foreign firms follows a similar pattern, there are interesting differences. Majority-owned foreign firms did not increase significantly their share in value added until 1987 (from 5.3 % in 1983 to 6.3 % in 1987). However, after the elimination of local equity participation and minimum export requirements in 1986 (Öniş, 1994: 96), majority-owned foreign firms realized a rapid growth in their valued added share throughout the period under consideration, and produced 20.6 % of manufacturing value added in 1996. In other words, all the expansion in value added share was achieved by majority-owned foreign firms, whereas minority-owned foreign firms (with equity participation within the 10-50 % range) kept their shares almost constant around 8-10 % since the mid-1980s (see also Tatoglu and Glaister, 1998).[8]

Table 1 summarizes the characteristics of domestic and foreign firms that were established after 1983. The variables 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, since foreign firms are on average large than domestic firms, the data for "large" domestic firms are presented for comparison.

As observed in many other countries, foreign firms in Turkey are characterized by

- larger size (in terms of the number of employees),
- use of more capital-intensive technologies,
- higher propensity to transfer technology from abroad,
- higher proportion of imported machinery in capital stock,
- R&D intensity,
- higher wages,
- lower proportion of the base wage in wage bill,

[8] Cieslik and Ryan (2002) also found a similar shift from minority-owned joint ventures in the Central and Eastern Europe in favour of wholly-owned foreign firms.

- advertisement intensity,
- avoidance of subcontracting relations,
- higher interest payments, and
- higher profit rates.

Moreover, although foreign firms are more likely to export (almost half of foreign firms export whereas the proportion of exporters among domestic firms is only 22 %), they tend to operate in import-competing (high ratio of import to apparent domestic consumption), and inward-oriented (low export intensity) sectors.

It is interesting to observe the fact that most of these differences exist between foreign firms and *large* domestic firms. The most notable change is observed in the share of imported machinery and export behavior. In terms of these variables, there is not any significant different between foreign and large domestic firms. Moreover, the degree of foreign ownership seems to be not so important. There is no substantial 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. Most importantly, foreign entrants are almost two times larger that domestic entrants (Hypothesis 1). As discussed in Introduction, the difference in entry size could be explained by real options theory and liquidity constraint. First, since foreign firms may have more information about their performance and, possibly, on market conditions as a result of their prior experience in other countries, the problem of sunk commitment could be less severe for foreign firms than domestic firms. Second, since foreign firms may have relatively abundant financial resources, and better access to external funding, they are not financially constrained. The fact that the interest payments/sales ratio is higher for foreign firms indicates that they easily raise external funding to finance their activities.

Does ownership matter for survival? Figure 2 shows that the survival rates for foreign and domestic firms are different. 40 % of domestic firms cannot survive until age 6, whereas the same (hazard) rate for foreign firms is only 20 %.[9] As in the case of other variables, the survival rates for minority and majority-owned foreign firms are almost the same. Moreover, large domestic firms' survival rates are comparable to those of foreign firms. This finding

[9] The log-rank test rejects the equality of the survival functions for domestic and foreign firms at the 5 % level.

points out that the 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, as the one in the following section.

4. Determinants of survival: An econometric analysis

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.

The econometric analysis of survival is based on the estimation of the hazard function that defines the probability of exit in a certain time period as a function of a set of time-varying covariates, conditional on being survived 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. The Cox model assumes a proportional hazard function that is defined by

$$h(t) = h_0(t)e^{X_t'\beta}$$

where $h_0(t)$ is the baseline hazard function, X is a vector of explanatory variables, and β is a corresponding vector of regression coefficients. The β parameters are estimated by the maximization of the partial likelihood function that does not require the specification of $h_0(t)$[10].

The dependent variable is the time of exit. The exit time of those plants that survived until the end of 1996 is not observed (the longitudinal data for the period 1983 to 1996 were used in the analysis). Thus the distribution of the dependent variable is censored at year 1996.

In the estimation of the Cox proportional hazard function, we use two sets of explanatory variables. The first set includes establishment-specific variables. The second set includes data

[10] There are alternative models where the functional form of $h_0(t)$ is explicitly defined as a certain distribution (exponential, Weibull, etc.). We estimated our model with different distributional assumptions. Since the results were similar, we report only the Cox proportional hazards model results.

about the characteristics of the industry defined at the 4-digit ISIC level in which the plant operates. This specification allows us to infer the plant- and sector-specific characteristics that determine the survival process.

One of the main purposes of this paper is to test if foreign establishments have different survival probabilities. We use a continuous variable, the share of foreign ownership (FDI), to test this hypothesis (Hypothesis 2). We also experimented with dummy variables for minority-, majority- and wholly-owned foreign firms, but results were not qualitatively different.[11]

Almost all empirical studies on survival find that the establishment size is one of the main determinants of survival (or hazard) probabilities (see Agarwal and Audretsch, 2001, and references therein). Therefore, we use the (log) number of employees to test the impact of size on survival (the LL variable). The average annual growth rate of the establishment since the entry year (LGR) is used to check if active learning, as proxied by growth, plays a role in determining the survival probability (Mata, Portugal, Guimarães, 1995). The interactions of these two variables with the FDI variable (LL*FDI, and LGR*FDI) are added into the model to check if the effects of size and learning (Hypothesis 3) differ between domestic and foreign firms.

The fourth hypothesis suggests that the foreign presence will reduce domestic establishments' survival probability because of intensified competition. The market share[12] of foreign firms, FDIMSH, is added into the model to test this hypothesis, whereas its interaction with the FDI variable (FDIMSH*FDI) is used to test the next hypothesis.

The following variables are also added into the Cox proportional hazard model to incorporate the effects of establishment- and industry-level characteristics.

KL is defined as the (log) capital/labor ratio where "capital" is calculated by the perpetual inventory method at the establishment level, and "labor" is measured by the number of employees. It is used to capture the effect of capital intensity of survival probability. ADVERINT (the advertisement expenditures/sales ratio), SUBINPUT (the share of subcontracted

[11] Estimation results for models with FDI dummy variables are available from the authors upon request.
[12] The "market" is defined at the ISIC 4-digit level (Rev. 2).

inputs in total inputs) and SUBOUTPUT (the share of output subcontracted by other firms in total output) are proxies for product and process characteristics. Advertisement will be higher for those products where "brand image" or reputation is important. Advertisement intensity may lead to rapid growth. Moreover, investment in advertisement is a sunk cost that cannot be recovered in other activities. Thus, exit will be less likely for advertisement intensive firms. Subcontracting can improve firms' flexibility and reduce exit costs, i.e., SUPINPUT and SUBOUTPUT variables may have a positive impact on hazard rates. The data for exporting firms are available since 1990. Therefore, we use a dummy variable for exporters, EXPDUM, to test if export-oriented firms have higher survival probability in the period 1990-95.

There are three variables regarding the technological level of the establishments: TECHTRAN (a dummy variables that takes value 1 if the establishment acquired a foreign technology through licensing, know how agreements, etc.), RDINT (R&D intensity, the R&D expenditures/sales ratio), and IMPMACH (the share of imported machinery in fixed capital stock). These variables measure various aspects of technological capability: TECHTRAN and IMPMACH reflect imported disembodied and embodied technology, respectively, whereas RDINT is a measure of in-house innovative capability. All these three variables are expected to have a positive impact on survival probability because technologically advanced establishments are expected to have better prospects in the future. (The RDINT and IMPMACH variables are available only since 1990.)

There are four variables about the financial aspects of the conduct of the establishments: INTPAY (the ratio of interest payments to sales revenue), PMARGIN (the profit margin, profits before taxes divided by sales revenue), PRSHARE ("profit sharing", the proportion of non-wage payments to workers in total payments for labor), and LW (the log wage rate). *Ceteris paribus*, higher interest payments means bigger financial burden on the establishment, i.e., higher hazard probability. PMARGIN will have the opposite effect: profitable establishments are more likely to survive. The wage rate (LW) measures the skill level: higher the skill level, higher the survival probability. PRSHARE 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 value of the PRSHARE variable may associate with higher hazard probability.

Finally, there are six industry-level variables. The entry rate (ENTRATE, the proportion of entrants in the industry) is related with the level of competition. An increase in the entry rate will lead to stiffer competition that will eventually reduce the survival probability. IMPENET and EXPINT are import intensity (the ratio between imports and apparent consumption), and export intensity (the ratio between exports and domestic output). These two variables are used to capture the effects of international competition on the survival probabilities. SECTGR and SECTGRPR are annual growth rates of real industrial output and output prices (at the industry level). These two variables are related with market prospects, and expected to have a positive impact on survival probability.

Cox proportional hazard model estimates are presented in Table 2 (columns 1-3). All models are stratified by ISIC 4-digit industries because the underlying hazard functions could be industry-specific. All models also include time-dummies to take into account the effects of the business cycles and other shocks on hazard rates. 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 (decreases) the hazard (survival) probability, whereas a coefficient smaller than 1 has the opposite effect.

The first model in Table 2 is estimated by using all observations, i.e., all establishments that exist in the period 1983-95. Since there is no information about the entry time and entry characteristics of those establishments that are observed the first time in the 1983 database, the growth rate (LGR) variable for those establishments is calculated as if they were established in 1983, and a dummy variable for these establishments are included into the model. The second model is estimated by using the data for all *entrants* for the period 1984-95, i.e., for those establishments that enter into the database after 1983. Finally, the third model is estimated for all entrants for the period 1990-95 to be able to use three additional explanatory variables, EXPDUM, RDINT, and IMPMACH, that are available only for that period.

All three models offer similar results: the establishment size and the growth rate are major determinants of survival. Large and rapidly growing establishments are less likely to exit from the market. In all three models, the presence of foreign establishments does not have any impact on hazard rates. Foreign establishments make life for others neither more difficult (through stiff competition), nor easier (through spillovers). This result is quite interesting because, for example, De Backer and Sleuwaegen (2003) have found at the industry level that

even in a developed country like Belgium, import competition and FDI stimulate exit of domestic firms, and discourage entry by domestic entrepreneurs.

In all three models, foreign ownership does not matter for survival. Neither the foreign ownership variable itself, nor its interactions with size, growth, and foreign presence have any impact on hazard probabilities. (The interaction between LGR and FDI variables is barely significant in the third model.) The joint significance of four foreign ownership variables (FDI, LL*FDI, LLGR*FDI, and FDIMSH*FDI) is also rejected by the log likelihood test in all survival models (see the FDI test statistics in Table 2).

Technologically advanced (the TECHTRAN, and IMPMACH variables), export-oriented (the EXPDUM variable) and skill-labor using (the LW variable) establishments have higher survival probabilities. All financial variables (INTPAY, PMARGIN, and PRSHARE) have the expected impact on hazard probabilities. Capital-intensive establishments and subcontractors find it easier to exit, whereas rapid growth in real industrial output and output prices improve survival prospects. Establishments operating in import competing industries have higher survival probabilities. This finding bears a resemblance to the so-called import discipline hypothesis.

Although it is not the main focus of our paper, we also estimate the growth equations for all entrants. The employment growth rate is defined as

$g_t = (L_t - L_{t-1})/L_{t-1}$

where L_t is the number of employees at time t. If the firm exits at time t, the employment growth rate will be equal to –1. Since the dependent variable is censored at –1, we use the following random effects Tobit specification to estimate the growth model:

$$g_{i,t} = \begin{cases} X'_{i,t-1}\beta + \alpha_i + \varepsilon_{i,t} & if \quad X'_{i,t-1}\beta + \alpha_i + \varepsilon_{i,t} > -1 \\ -1 & if \quad X'_{i,t-1}\beta + \alpha_i + \varepsilon_{i,t} \le -1 \end{cases}$$

where α_i's are random establishment-specific effects.

All explanatory variables are the same as in the survival model with only one exception. Instead of the average growth rate variable, LGR, we use the (log) age of the establishment (LAGE) because previous studies show that establishment size is one of the main determinants of growth rates.

As may be expected, the estimation results of the growth model are somewhat similar to the estimation results of the survival model though there are some interesting differences.

The size of the establishment has a weak positive impact on the growth rate, because small establishments, as found before, are more likely to exit (however, this impact is not statistically significant in the period 1984-95, providing a weak support for the Gibrat's law). Establishment age has a negative impact on the growth rate, i.e., young establishments, *ceteris paribus*, grow faster. But this relationship does not receive any support from the data for the shorter time period (1990-95).

The presence of foreign establishments does not have any impact on the growth rates of domestic and foreign establishments alike (the coefficients of the FDIMSH and FDIMSH*FDI variables are statistically insignificant). Foreign establishments have higher growth rates than domestic establishments: the coefficient of the FDI variable is positive and statistically significant for both time periods.[13] However, this impact gets smaller for large and/or old foreign establishments (negative coefficients for the LL*FDI and LAGE*FDI variables). In other words, although foreign establishments start large compared to the domestic establishments, they are nevertheless small compared to their "optimal" size, and, hence, achieve growth rates faster that domestic establishments or large/old foreign establishments do. These results show that foreign firms, although they are in a better financial position, and have prior experience, are cautious in entering a foreign market, and tend to grow rapidly after gathering information on market conditions and its performance. Foreign firms could achieve faster growth rates especially in the early post-entry period because they are not financially constrained as a result of higher profit rates and access to external funds.[14] These results support hypotheses 6 and 7.

[13] The joint significance of the FDI variables is not rejected at the 5 % level for the period 1984-95 and at the 11% level for the priod 1990-95.

[14] Mata and Portugal (2002) and Blonigen and Tomlin (2001) also find that foreign firms achieve faster growth especially during their early infancy.

5. Conclusions

In this paper, we analyze the impact of foreign direct investment on the dynamics of foreign and domestic establishments, i.e., entry, selection (exit), and growth processes. We obtain three main conclusions on the basis of our analysis on foreign and domestic establishments in Turkish manufacturing industry for the period 1983-96:

First, there are significant differences between entry characteristics of foreign and local firms. Most importantly, foreign entrants are almost two times larger that domestic entrants. At the time of entry, foreign firms use more capital intensive technologies, pay higher wages, have better access to formal sources of funding, are more profitable, and have a stronger tendency to export relative to domestic firms.

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

Third, although foreign firms are less likely to go bankrupt, neither foreign ownership itself nor foreign presence in the market matter for survival. What matters is other firm-characteristics such as the size of the firm, the growth rate of the firm, the cost of external funding, profitability, quality of the labor force, etc. In other words, foreign firms are less likely to go bankrupt not because of their foreign ownership, but because of their (initial) size and other characteristics. However, foreign firms, even after controlling for other characteristics, seem to achieve higher growth rate in their early years.

Policy implications of our findings can be summarized as follows:

First, the foreign ownership and the presence of foreign firms in the market do not have any impact on the survival of domestic (and foreign) firms. Therefore, i) there is no need to fear that foreign firms impose an unduly pressure on domestic firms, and ii) there is no need to expect positive gains from FDI in the form of better passive learning. In other words, the enterprise policy should be ownership-neutral.

Second, there are considerable differences between entry characteristics of foreign and domestic firms, and these differences are persistent, and determine the post-entry performance and survival probability. Entry characteristics are extremely important for the performance of firms, the efficiency of the competition process, and, the performance of the economy. Therefore, the enterprise policy should aim at influencing entry characteristics through focusing on training of entrepreneurs, providing managerial and technical information, facilitating technology transfer, providing initial financial support (seed and venture capital), etc.

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Figure 1. Share of foreign establishments in Turkish manufacturing, 1983-96

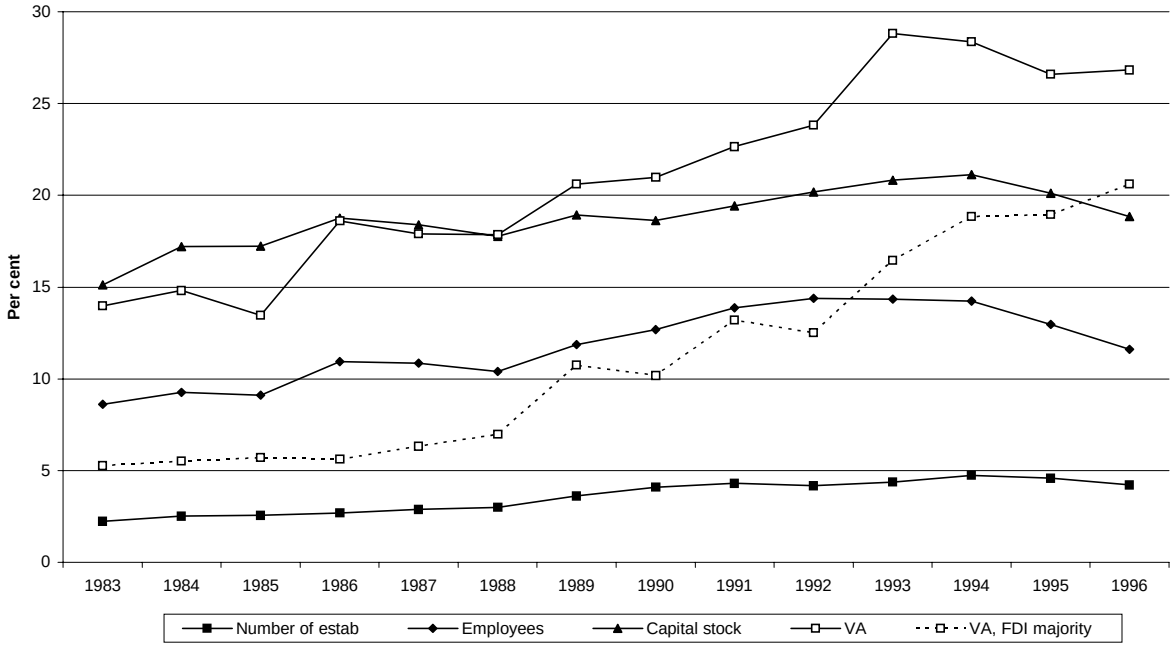

Figure 2. Survival functions of foreign and domestic establishments

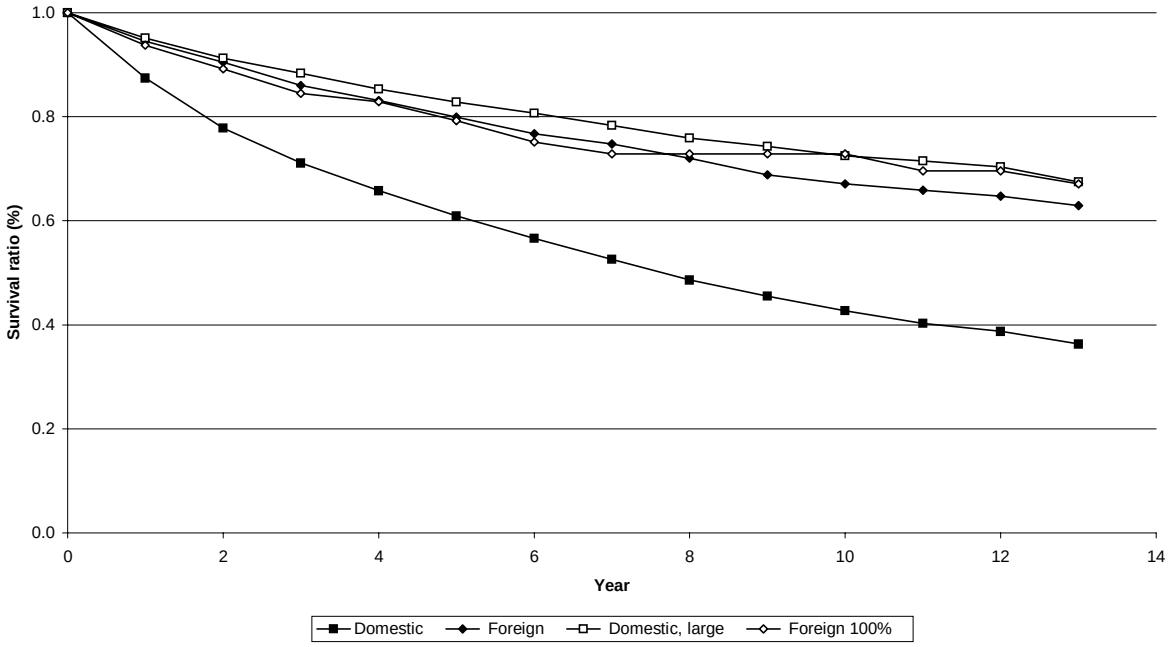

Table 1. Descriptive statistics (mean values)

Label	Description	All observations				Entry year observations			
		Domestic	Large domestic	Foreign 10%+	Foreign 50%+	Domestic	Large domestic	Foreign 10%+	Foreign 50%+
Establishment-level variables									
LL	Log number of employees	3.965	5.634	4.886	4.802	3.725	5.622	4.498	4.347
L	Number of employees	53	280	132	122	41	276	90	77
FDI	Share of foreign ownership	0.000	0.001	0.614	0.777	0.000	0.001	0.626	0.761
LLGR	Annual employment growth rate	0.049	0.140	0.072	0.073				
KL	Log capital/labor ratio	3.438	3.818	4.329	4.376	3.656	4.083	4.221	4.208
ADVERINT	Advertisement/sales ratio	0.003	0.005	0.010	0.011	0.003	0.005	0.012	0.013
SUBINPUT	Subcontracted input share	0.034	0.042	0.026	0.026	0.032	0.024	0.029	0.030
SUBOUTPUT	Subcontracted output share	0.077	0.064	0.051	0.056	0.097	0.087	0.058	0.065
TECHTRAN	Technology transfer dummy	0.010	0.041	0.189	0.214	0.006	0.041	0.131	0.131
INTPAY	Interest payments/sales ratio	0.025	0.050	0.054	0.048	0.020	0.055	0.070	0.060
PMARGIN	Profit margin	0.139	0.185	0.236	0.255	0.132	0.170	0.191	0.184
PRSHARE	Share of non-wage payments in wage bill	0.076	0.158	0.190	0.190	0.059	0.169	0.169	0.165
LW	Log wage rate	1.997	2.376	2.926	3.044	1.885	2.337	2.737	2.843
IMPMACH	Share of imported machinery	0.116	0.249	0.256	0.258	0.098	0.216	0.191	0.187
RDINT	R&D/sales ratio (*100)	0.082	0.116	0.155	0.166	0.063	0.062	0.083	0.076
EXPDUM	Exporter dummy	0.220	0.447	0.462	0.485	0.168	0.342	0.402	0.421
Sector-level (ISIC +-digit level) variables									
FDIMSH	Market share of foreign establishments	0.106	0.097	0.185	0.188	0.096	0.091	0.161	0.163
ENTRATE	Entry rate	0.065	0.063	0.057	0.057	0.081	0.091	0.087	0.081
IMPENET	Import penetration	0.149	0.115	0.197	0.179	0.144	0.111	0.178	0.165
EXPINT	Export intensity	0.328	0.365	0.275	0.264	0.344	0.324	0.297	0.304
SECTGR	Output growth rate	0.104	0.118	0.116	0.106	0.142	0.196	0.164	0.153
SECTGRPR	Growth rate of output price	0.532	0.546	0.545	0.562	0.490	0.482	0.491	0.512
Number of observations (1983-96)		33284	3217	1237	791	8094	389	236	160
Number of observations (1990-96)		21412	2369	917	625	3985	196	122	95

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

mimprat, rdint, and expdum variables are available for 1990-96.

Table 2. Survival and growth models estimation results

	Cox proportional hazard model						Employment growth model			
	1983-95, all estab.		1984-95, all entrants		1990-95, all entrants		1984-95, all entrants		1990-95, all entrants	
	Haz. Rat.	Std. Err.	Haz. Rat.	Std. Err.	Haz. Rat.	Std. Err.	Coeff.	Std. Err.	Coeff.	Std. Err.
LL	0.484	0.015 **	0.495	0.022 **	0.500	0.031 **	0.007	0.008	0.020	0.007 **
LGR	0.151	0.025 **	0.222	0.043 **	0.141	0.038 **				
LAGE							-0.076	0.007 **	0.004	0.006
FDI	0.302	0.232	0.381	0.383	2.683	3.408	0.631	0.161 **	0.259	0.151 *
LL*FDI	1.319	0.227	1.197	0.284	0.764	0.230	-0.106	0.035 **	-0.045	0.033
LAGE*FDI							-0.074	0.039 *	-0.081	0.046 *
LGR*FDI	1.184	1.388	2.395	2.614	12.617	18.752 *				
FDIMSH	0.918	0.172	0.907	0.206	0.824	0.304	0.032	0.028	0.025	0.027
FDIMSH*FDI	1.060	1.032	1.106	1.228	0.730	1.009	0.028	0.171	0.138	0.155
KL	1.103	0.012 **	1.125	0.017 **	1.013	0.024	0.034	0.005 **	0.026	0.004 **
ADVERINT	0.147	0.177	0.385	0.533	0.601	1.162	0.586	0.260 **	0.768	0.294 **
SUBINPUT	1.071	0.178	1.123	0.205	1.077	0.325	0.051	0.047	0.164	0.058 **
SUBOUTPUT	1.248	0.065 **	1.270	0.076 **	1.028	0.184	-0.050	0.018 **	0.030	0.038
TECHTRAN	0.756	0.113 *	0.759	0.170	1.025	0.261	0.004	0.032	-0.027	0.032
INTPAY	3.892	0.560 **	2.792	0.570 **	2.811	0.958 **	-0.255	0.057 **	-0.254	0.069 **
PMARGIN	0.769	0.015 **	0.791	0.018 **	0.801	0.033 **	0.090	0.010 **	0.091	0.013 **
PRSHARE	2.448	0.339 **	1.850	0.340 **	2.535	0.662 **	-0.169	0.042 **	-0.249	0.048 **
LW	0.673	0.021 **	0.730	0.028 **	0.819	0.047 **	0.106	0.008 **	0.055	0.010 **
ENTRATE	0.988	0.397	0.586	0.287	0.955	0.763	0.075	0.080	0.055	0.103
IMPENET	0.472	0.134 **	0.488	0.180 *	1.455	1.360	-0.018	0.027	0.027	0.027
EXPINT	1.004	0.085	0.946	0.106	1.008	0.322	0.090	0.013 **	0.023	0.014 *
SECTGR	0.949	0.040	0.913	0.046 *	0.867	0.069 *	0.018	0.009 *	0.026	0.012 **
SECTGRPR	0.477	0.066 **	0.609	0.096 **	0.506	0.105 **	0.130	0.030 **	0.140	0.034 **
IMPMACH					0.652	0.104 **			0.153	0.024 **
RDINT					0.954	0.032			0.006	0.005
EXPDUM					0.631	0.043 **			0.060	0.010 **
# observations	60603		29744		18131		28704		17511	
# firms	11181		7404		5469		7346		5401	
# exits	5670		3631		1867		3631		1867	
Wald test, χ^2	1970 **		921 **		715 **		790 **		519 **	
FDI test, $\chi^2_{(4)}$	2.27		2.14		2.04		20.56 **		7.61 +	
Log likelihood	-27192		-16851		-7239		-24885		-14252	

** (*) means statistically significant at 5% (10%) level. Robust standard errors in brackets. Hazard models are stratified by ISIC 4-digit industries.

All models include time dummies. The first model includes a dummy variable for incumbents in 1983.