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Firm Survival in the Netherlands

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Abstract. The purpose of this paper is to examine whether the dynamics of industrial organization differ in the Netherlands from what has emerged as a *Stylized Fact* in other countries. Because the Netherlands has pursued a unique set of institutions and policies comprising what has become known as the Polder Model, the factors leading to firm failure may systematically differ from those in other countries. We address this question using a longitudinal database from *Statistics Netherlands* (CBS) that identifies over two thousand firms in manufacturing and then tracks their performance over time.

Key words: Exit, manufacturing industries, survival.

JEL classification: L1

I. Introduction

As Ed Mansfield (1962) observed nearly three decades ago, virtually nothing was known in the industrial organization literature about the dynamics of industrial organization, or about what happens to firms over time.[1] The response of industrial organization scholars was to generate a wave of studies in the past decade focusing on the dynamics of industrial organization, and in particular, the propensity for

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[1] According to Mansfield (1962, p. 1023), "Because there have been so few econometric studies of the birth, growth, and death of firms, we lack even crude answers to the following basic questions regarding the dynamic processes governing an industry's structure. What are the quantitative effects of various factors on the rates of entry and exit? What have been the effects on a firm's growth rate? What determines the amount of mobility within an industry's size structure?"

firms to survive and grow. This literature has been so compelling that Paul Geroski (1995) was able to uncover a set of *Stylized Facts* about the propensity for firms to survive over time that emerged with remarkable consistency.

However, whether the *Stylized Facts* identified by Geroski hold in countries with different institutions and policies is less certain. For example, the Dutch Polder Model has been generally attributed with triggering economic revival in the Netherlands. In the Dutch Polder Model, institutions and policies facilitating consensus and cooperation among firms, labor and government have played a central role. An explicit policy of this consensus has been to promote the stability of firms. Thus, it might be expected that the *Stylized Facts* about firm survival emerging from the studies reviewed by Geroski (1995) do not hold in the Netherlands.[2] The purpose of this paper is to examine whether the different institutional setting of the Netherlands under the Polder Model has resulted in altering the determinants of firm survival from what has emerged as a *Stylized Fact* in other countries.[3] We address this question using a longitudinal data base from *Statistics Netherlands* (CBS) that identifies 2,017 firms in manufacturing and then tracks their performance over the subsequent years. We find that the likelihood of survival varies considerably across firms depending upon the characteristics of both firms and industries that are consistent with the empirical evidence found in North America and elsewhere in Europe. That these results emerge despite important data qualifications that distinguish this data set from those analyzed in other countries reinforces the similarity in results. This suggests that while the institutions and policies of the Dutch Polder Model may be unique to the Netherlands, the dynamics of industrial organization are the same as in North America and in other European countries.[4]

II. Measurement

The ability to measure firm survival depends upon access to a longitudinal data set containing observations tracking firms over time. We use a longitudinal database of manufacturing firms in the Netherlands from the Annual Production Statistics compiled at *Statistics Netherlands.*[5] The Production Statistics contain detailed in-

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[2] See “Dutch Take ‘Third Way’ To Prosperitym” *New York Times*, 16 June, 1997, p. A6 for a popular outsiders? view, Kleinknecht (1998) for a critical comment and McKinsey Global Institute (1997) for additional policy recommendations.

[3] For a review of studies identifying the survival rates in North America and Europe, see the Special Issue of the *International Journal of Industrial Organization* on *The Post-Entry Performance of Firms* (Audretsch and Mata, 1995).

[4] See Bais and Van Uxem (1996), Van der Hauw, Nijssen and Van Uitert (1996), Lind van Wijngaarden (1996) and Wennekers (1997) for further data and references to specific Dutch material on startups and survival.

[5] Similar longitudinal databases have now been used to study the likelihood of survival of manufacturing firms in the United States, Germany, Canada, Portugal and Italy. New-firm survival in the United States was studied by Audretsch (1991) and Dunne, Roberts and Samuelson (1988). An analysis of new German firms has been performed by Wagner (1994). Entry and exit of Canadian

formation on all firms in Dutch manufacturing. Data are available for each year between 1978 and 1992. In 1987 a structural change occurred in the sampling procedure. The Production Statistics until 1986 contain all establishments with at least ten employees, whereas data sets from the years after 1986 consist of all firms with at least twenty employees and only a sample of the firms with less than twenty employees.[6]

As a result of this measurement procedure at Statistics Netherlands, the database contains only new firms that have attained this minimum size. The main disadvantage of this minimum size is that most firms actually start with fewer than ten employees. This means we are only able to track the performance of firms that have already grown to this minimum size. This will tend to bias our empirical results towards higher survival rates than if we were able to include firms at the moment of conception. However, one of the advantages of having a minimum firm size in the database is that it eliminates some of the noise in the data involved in identifying new-firm startups. Dun and Bradstreet data which are used to identify new-firm startups in the United States have been criticized because of their inability to accurately identify when a new firm is started and to mistake some restructured firms for new firms (MacDonald, 1985). Jacobson (1985) found that such underreporting of new-firm startups tended to be particularly severe in new industries, such as microcomputers and software-related industries. Using a minimal firm size standard reduces this type of measurement error in more accurately identifying when a *bona fide* new firm is started. Throughout the remainder of this paper we use the term new-firm startup to refer to new firms that have passed this critical minimal firm size standard.

A new firm is identified when it appears in the data file in year t but not in any of the years preceding t. The firm is considered to exit if it is present in the year t but not in year $t+1$, $t+2$, ..., 1992. This longitudinal check is necessary, because in addition to a permanent closing down of its operations, a firm may not be in a particular year's database, because its employment level has temporarily dropped below the limit of ten employees. Following Wagner's (1994) recommendation that "conclusions should not be based on the analysis of data from a single cohort of entries", we extract four distinct cohorts of new firms from the database to analyze the subsequent likelihood of survival. These four cohorts consist of new-firm startups in each year between 1979 and 1982. Each enterprise is then tracked over the subsequent ten years.

There are three important qualifications that need to be made about the database. First, this data base is not identical to those analyzed in the United States and Canada in that firms with fewer than ten employees are not included in the data

firms were studied by Baldwin and Gorecki (1991). Evidence for Portugal was supplied by Mata (1994). Research on Italian data was done by Arrighetti (1994). However, these data sets suffer from drawbacks. For instance, the USELM file from the U.S. Small Business Administration provides only biennial observations on variables such as employment level and ownership status.

[6] Only two percent of the firms drop out of the database.

base. Second, more than one-half of the observations in the first year are in three industries and 71 percent are in five industries, so that the composition of these firms across industries is not the same as in other countries. Third, the choice of 1979–1982 as a base year may not be ideal in that this was the second largest post war recession in the Netherlands.[7] Any evidence based on analyzing this data base that the determinants of firm survival in the Netherlands differ from that found in North America and elsewhere in Europe could be, at least partially, attributable to these discrepancies in measurement. However, findings that suggest no differences in the determinants of firm survival between the Netherlands and other countries would actually be strengthened in light of the differences in measurement.

Table I shows the number of startups in each major manufacturing industry and then tracks the subsequent performance of the new firms over time. For example, while over 91 percent of the startups in the food industry survived two years, only 47 percent survived a decade. The ten-year survival rates vary considerably across industries, ranging from 32 percent in apparel and 35 percent in rubber to 75 percent in paper and 65 percent in chemicals. This high variation in survival rates across industries is consistent with that found in other European countries and in North America.

III. Linking Survival to Firm and Industry Characteristics in a Logit Model

As Geroski (1995) points out, studies on survival have typically linked the propensity for a firm to survive to characteristics specific both to the firm and the industry. We therefore use a logit regression model where the dependent variable is assigned a value of one if the firm still exists and zero if it has exited. The independent variables reflect different aspects of industry structure and firm-specific characteristics. The first aspect of industry structure is the degree of scale economies. While the level of scale economies cannot be precisely determined, it is clearly more important in some industries than in others. The minimum efficient scale (MES) level of output, or the smallest level of output where scale economies have been exhausted, has been found to vary substantially across industries (Weiss, 1976; Scherer, 1973; Audretsch and Mata, 1995; Audretsch and Mahmood, 1995). This means that a firm with only a few employees is confronted with more of an inherent size disadvantage – in that it is operating at a level of output that is below the minimum efficient scale (MES) – in some industries than in other industries. Weiss (1976) and Scherer (1973) conclude that such small firms operating at a level of output below the MES level are *sub-optimal*, since their average costs exceed that of larger, more efficient firms. As Weiss (1991, p. 403) explains, “The term ‘sub-optimal’ describes a condition in which some plants are too small to be efficient”. We predict the likelihood of survival will therefore be positively related to the startup size of the firm and negatively related to the importance of scale economies.

[7] We are grateful to an anonymous referee for pointing out these three important data qualifications to us.

Table I. Number of start-ups and percentage of surviving start-ups by industry and age of cohort

Industry	Number of start-ups	Age of cohorts 2	4	6	8	10
Food	426	0.91	0.81	0.71	0.58	0.47
Textiles	46	0.91	0.78	0.59	0.54	0.52
Apparel	37	0.73	0.57	0.46	0.41	0.32
Lumber	80	0.91	0.64	0.59	0.49	0.41
Furniture	131	0.82	0.62	0.49	0.43	0.37
Paper	12	0.92	0.92	0.92	0.83	0.75
Printing	221	0.90	0.76	0.69	0.62	0.52
Petroleum	44	0.86	0.77	0.64	0.52	0.43
Chemicals	79	0.91	0.81	0.71	0.66	0.65
Rubber	17	0.71	0.47	0.35	0.35	0.35
Leather	87	0.95	0.82	0.69	0.63	0.51
Stone. clay. glass	6	1.00	0.83	0.67	0.67	0.50
Primary metals	487	0.77	0.54	0.46	0.39	0.36
Fabricated metal products	166	0.89	0.70	0.62	0.57	0.49
Machinery (non-electric)	1	0.00	0.00	0.00	0.00	0.00
Electrical equipment	168	0.84	0.66	0.54	0.48	0.42
Instruments	9	0.78	0.56	0.44	0.44	0.44
Entire manufacturing	2017	0.86	0.69	0.59	0.52	0.44

We measure the *startup size* of the firm as the number of employees in the firm in the year the firm enters our data set. The importance of *scale economies* is measured by the share of production costs accounted for by energy and depreciation costs (which are assumed to be in fixed proportion to the variable firm capital intensity, which is not available in our database). The firm should be able to offset any capital disadvantage through its own capital intensity, so we also include the capital-intensity of the firm as well as the capital-intensity of the industry.

The cost disadvantage confronting a sub-optimal scale firm will be alleviated in industries where the price is elevated above the long-run average cost. The extent to which the price level exceeds long-run average cost creates a type of umbrella, under which sub-optimal scale firms are protected.[8] If the price level is at the competitive level and equal to long-run average cost, a sub-optimal scale firm will be confronted with a cost disadvantage. However, in an industry where the price level

[8] Leonard Weiss (1979, p. 1137) argued, in fact, that it was the existence of such a price umbrella that was the greatest welfare cost imposed by market power and advocated any public policy which "… creates social gains in the form of less sub-optimal capacity".

greatly exceeds costs the sub-optimal scale firm is no longer subjected to such a size inherent cost disadvantage. The *industry price–cost margin*,[9] which measures the degree to which price is elevated above marginal costs, should therefore be positively related to the likelihood of survival.

Audretsch (1995) has argued and found evidence that one of the major reasons why new firms are started is that entrepreneurs are pursuing new ideas that were rejected by incumbent firms.[10] These new ideas are uncertain. But just because an entrepreneur thinks that his idea is a good one, does not mean, in fact, that it is, or at least that it is viable in the market. According to the theory of noisy selection by Jovanovic (1982), entrepreneurs start new firms because they have an idea that they value more highly than do the incumbent firms. The entrepreneur then discovers the actual value of the idea only through actual experience in the market. If the idea proves to be valuable the new firm grows and remains in the market. If the idea proves not to be valuable, the new firm will stagnate and ultimately exit from the market.

The knowledge conditions underlying an industry have been found in the United States to influence the extent to which new firms are being started because of a divergence in beliefs in the value of new ideas (Audretsch, 1995). Audretsch et al. (1996) show that industries in which R&D plays an important role tend to be better characterized by high uncertainty, asymmetric information and high costs of transacting that information when compared to industries with little R&D. We include *R&D*, measured as the share of total industry employment accounted for by employees involved in R&D, to reflect the underlying knowledge conditions of the industry. We would expect the likelihood of survival to be lower in industries where R&D plays a more important role, since uncertainty tends to be greater in such industries. Similarly, industries in the early stages of the life cycle are typically associated with less product standardization and greater uncertainty. We capture this life cycle effect with the *growth rate*, measured as the average of the annual industry sales growth rates between 1978 and 1991. We expect the likelihood of new-firm survival to be lower in high growth industries, since such industries are characterized by greater high uncertainty.

The theory of population ecology developed Hannan and Freeman (1989) argues that the likelihood of any particular new firm surviving is lower in populations where there are a greater number of other competing new entrants. If a new firm is the only entrant it should have a greater chance of survival than if it must compete with a high number of new entrants. Thus, we include the industry *entry rate*,

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[9] The price–cost margin is defined as (Revenues–Costs)/Revenues, where Revenues equals value-of-shipments plus the margin on trading and other revenues, and Costs equals the sum of total consumption value, labor costs, interest expenses (less interest income), miscellaneous income (less expense) and depreciation costs on fixed assets.

[10] Nooteboom (1994) argues that there is considerable variance in the backgrounds and motives of entrepreneurship. Discontent with the present position is only one of the push factors. Next to push factors he also discriminates between pull factors and coincidence as a condition for starting a business.

measured as the number of new firms divided by the total number of firms in the industry, computed in the startup year. We expect the industry entry rate to have a negative impact on the likelihood of new-firm survival.

The debt structure of a firm may actually pose a barrier to exit. The firm's *debt structure* is hypothesized to have a positive influence on its chances of survival for at least two reasons. First, agency theory in finance (Jensen, 1986) suggests that a higher debt-equity ratio – and hence higher interest payments – limits the free cash-flows available to the firm's managers, who may be inclined to invest these cash-flows in dubious projects. Second, Caves and Porter (1976) argue that in the phase following the firm's entry, a high level of financial investment turns out to be a barrier against the entry of new competitors and simultaneously constitutes a high barrier to exit. Some new firms may have a higher degree of debt because they are operating in an industry where all firms tend to have a high degree of debt. To control for this we include the industry debt structure as well as the firm debt structure

Finally, we also include three dummy variables representing the influence of the specific cohort to which the firm belongs. These dummy variables can be interpreted as reflecting the impact of omitted macroeconomic variables specific to the startup year.

IV. Results

The logit model for new-firm survival specifies the exogenous variables in a straightforward linear fashion. The model is estimated for different time intervals, varying between two and ten years. This enables to determine how the determinants of firm survival vary between the short and long run. After estimating the model for each cohort separately, we were able to reject the hypothesis that the regression coefficients of the variables differ across cohorts. We conclude that it is appropriate to pool the four cohorts together in estimating the model. Because for several variables the mean value was different for different cohorts, it was necessary in the pooled regression to work with standardized variables, i.e., from each variable we subtracted its cohort average.

The results are provided in Table II. The negative and statistically significant coefficient of the industry capital intensity suggests that the likelihood of survival tends to be lower in industries which are capital intensive and where scale economies play an important role. This impact is not statistically significant in the short run and becomes statistically significant only six years subsequent to the startup year. At the same time, as the positive and statistically significant coefficients of the firm startup size and the firm capital intensity show (for both the long and short run), the firm can, at least to some extent, compensate by increasing its startup size and capital intensity. Both effects increase the likelihood of survival.

The positive and statistically significant coefficient of the price–cost margin suggests that a price umbrella tends to protect new firms by elevating their like-

Table II. Logit regression estimates for new-firm survival (t-statistics in parentheses)

Variable	Age of cohorts 2	4	6	8	10
Size disadvantage					
Capital intensity					
Industry	−3.66	−3.69	−5.90	−4.91	−5.22
	(0.84)	(1.32)	(2.44)	(2.10)	(2.21)
Firm	10.64	7.49	7.08	6.08	5.34
	(4.43)	(4.90)	(5.24)	(4.81)	(4.39)
Size					
Industry	0.00	0.00	0.00	0.00	0.00
	(0.44)	(0.90)	(1.11)	(1.04)	(1.25)
Firm	0.04	0.02	0.01	0.01	0.01
	(5.99)	(5.44)	(3.65)	(4.01)	(3.75)
Price umbrella	5.27	5.16	4.36	2.37	0.73
	(2.04)	(2.80)	(2.60)	(1.51)	(0.48)
Exit barriers					
Debt structure					
Industry	0.03	0.03	0.04	0.03	0.02
	(0.52)	(0.67)	(1.02)	(0.71)	(0.58)
Firm	0.01	−0.02	−0.03	−0.02	−0.02
	(0.56)	(1.58)	(3.15)	(1.93)	(1.66)
Industry life cycle					
R & D	−4.17	−3.80	−2.44	−4.57	−3.99
	(0.85)	(1.00)	(0.69)	(1.35)	(1.18)
Growth	−6.06	−6.60	−5.35	−2.50	0.53
	(2.36)	(3.40)	(2.94)	(1.40)	(0.29)
Entry rate	−2.36	−2.51	−3.09	−3.55	−3.79
	(1.58)	(2.25)	(2.93)	(3.38)	(3.53)
Cohort control variables					
Constant	2.19	1.09	0.54	0.29	0.08
	(16.47)	(11.57)	(6.34)	(3.48)	(0.93)
Dummy cohort 1980	−0.05	−0.42	−0.22	−0.38	−0.50
	(0.25)	(3.14)	(1.77)	(3.14)	(4.12)
Dummy cohort 1981	−0.16	−0.41	−0.21	−0.33	−0.40
	(0.83)	(2.91)	(1.62)	(2.62)	(3.11)
Dummy cohort 1982	−0.57	−0.17	−0.16	−0.20	−0.41
	(3.19)	(1.16)	(1.20)	(1.53)	(3.20)
Statistics					
No. of survivors (out of 2017)	1730	1391	1199	1043	896
Survival rate	0.86	0.69	0.59	0.52	0.44
Log likelihood	−769	−1192	−1317	−1357	−1348

lihood of survival, at least within the first six years of existence. However, the statistically insignificant coefficient of the price-cost margin for cohorts older than eight years indicates that this protective umbrella is not effective in the long run.

There is at least some evidence that the likelihood of new-firm survival is lower in industries characterized by greater uncertainty. The coefficients of both R&D and the growth rate are both negative. This impact seems to be greater in the short run than in the longer run. Finally, the negative relationship between the entry rate into an industry and the likelihood of new-firm survival, which is statistically significant after four years subsequent to startup, provides at least some support for the organizational ecology theory of Hannan and Freeman (1989). The likelihood of survival is apparently lower in markets where there is greater entry.

Neither the firm nor the industry debt structure exerts much of an impact on the likelihood of new-firm survival. Thus, we cannot infer any support for the Caves and Porter (1976) hypothesis that the debt structure creates a barrier to exit.

These results indicate that the likelihood of new-firm survival is not constant across industries but is rather shaped by the environment in which the firm is operating. A new firm that is started in an industry which is capital intensive and where scale economies play an important role, and where new knowledge is particularly uncertain, will tend to be confronted with a lower likelihood of survival. In addition, the likelihood of survival for a new firm tends to be lower in industries where there are a lot of other new firms. However, the prospects of a new firm are not completely dependent upon the external environment. To some extent the new firm can offset the lower likelihood of survival through a larger start-up size and a greater degree of capital intensity.

V. Conclusions

A fundamental issue in industrial organization is whether empirical evidence that is so compelling as to constitute *Stylized Facts* (Geroski, 1995) under one set of institutional conditions in one set of countries, holds in other countries with different institutions. The Polder Model in the Netherlands is based on a strong consensus between the employers associations (firms), labor unions and government. An explicit goal of this consensus is to provide stability among the firms. The empirical evidence found in this paper suggests that the underlying sources of firm failure are the same in the Netherlands as found elsewhere. These results are even more striking because the sample of firms analyzed is not identical in terms of size, age and industry to samples typically analyzed in other countries. In particular, the evidence clearly suggests that the likelihood of firm survival is shaped by characteristics specific both to the firm and the industry environment in a manner that is strikingly consistent with the *Stylized Facts* identified by Geroski. In terms of firm-specific characteristics we find that the likelihood of survival increases with firm age and firm size. In terms of the industry-specific characteristics, we find that the likelihood of survival is lower in R&D intensive industries and in industries that are capital intensive and where scale economies play an important role. These results lead us to conclude that the dynamics of industrial organization are strikingly similar even across countries with very different institutions and policies. The dynamics of industrial organization are apparently more shaped by the knowledge and technological conditions underlying industries and firms and less by institutional differences across countries.

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