Do Services Differ from Manufacturing? The Post-Entry Performance of Firms in Dutch Services

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Abstract: A large literature has emerged focusing on the post-entry performance of firms and, in particular, on the links between firm growth, survival, size and age. While these studies have resulted in findings that are sufficiently consistent as to constitute Stylized Facts, virtually all of these studies are based on manufacturing. The purpose of this paper is to fill this gap in knowledge about the role of non-manufacturing in industrial organization, and in particular, in the post-entry performance of firms, or what happens to firms subsequent to entering an industry. We suggest theoretical reasons why the relationships between firm age and size on the one hand, and survival and growth on the other may, in fact, not be the same in services as they are for manufacturing. We use a longitudinal data base for Dutch firms in the retail and hotel and catering sectors to identify around 13,000 new-firm start-ups and 47,000 incumbents in the services and track them over subsequent years. Our results suggest that the most fundamental relationships between firm size, age, survival and growth are strikingly different for services than for manufacturing. In terms of the dynamics of industrial organization, services may, in fact, not simply mirror the manufacturing sector.
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1. Introduction

In response to a literature that focused on static relationships in industrial organization, Mansfield (1962, p. 1023) made a plea some 35 years ago for a greater emphasis on understanding the dynamic process by which industries evolve over time, “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?” Industrial organization scholars responded to Mansfield’s plea by undertaking a wave of studies focusing on the various dimensions of industry evolution. The resulting literature on intra-industry dynamics examines the process by which new firms enter an industry, either survive or exit, and grow to even displace incumbent firms in some cases. Paul Geroski (1995) was able to comb through a diverse set of studies spanning a broad spectrum of countries, time periods, and methods of analysis, to uncover a set of Stylized Facts that emerge with remarkable consistency to answer the question, “What Do We Know About Entry?” While the studies upon which Geroski bases his Stylized Facts are disparate in many dimensions, they all have one thing in common – they are all based upon manufacturing. Although never explicitly stated by Geroski, an important qualification to his insightful synthesis of the literature is that whatever it is we know about entry as will as the dynamic process by which firms and industries evolve over time, it is about manufacturing. There is virtually nothing known about the entry and post-entry processes in the non-manufacturing sectors. This void in knowledge about industrial organization is particularly striking since manufacturing accounts for less than one-quarter of employment in most of the OECD countries. Most workers and economic activity occurs outside of the manufacturing sector. This gap in knowledge about the applicability of findings from manufacturing to services has led Davis, Haltiwanger and Schuh (1996a and 1996b) to call for the development of longitudinal firm level data sets for the service industries.

The purpose of this paper is to fill this gap in knowledge about the role of non-manufacturing in industrial organization, and in particular, of firms, or what happens to firms subsequent to entering an industry. The literature on the post-entry performance has a particular focus on the relationships between firm size and age on the one hand, and survival and growth on the other. As Geroski (1995) emphasizes, virtually every study undertaken, independent of the country, time period and methodology employed has found positive relationships between the likelihood of survival and firm age and size, but negative relationships between firm growth and age and size. I a more recent study, Sutton (1997) reports on similar relationships in his exhaustive survey on Gibrat’s Law, i.e., the Law of Proportionate Effect, and the wave of studies on the dynamics of firm size and industry structure that emerged subsequent to Gibrat’s pioneering book (Gibrat, 1931).[1] In the second section of this paper we introduce the longitudinal data base for Dutch firms in the retail and hotel and catering sectors to identify around 13,000 new-firm start-ups and 47,000 incumbents in the services and track them over subsequent years. Throughout this paper we will use the term hospitality for the hotel and catering sectors. In the third section, we use this longitudinal data base to identify whether the relevant Stylized Facts from manufacturing pointed out by Geroski also apply to services. In the fourth section we suggest theoretical reasons why the relationships between firm age and size on the one hand, and survival and growth on the other may not be the same in services as they are for manufacturing. We then test to see whether the Stylized Results identified by Geroski based on manufacturing still hold in the services. In the final section we provide a summary and conclusions. The results suggest that while a number of Stylized Facts regarding entry based on manufacturing are confirmed for services, the most fundamental relationships between firm size, age, survival and growth are strikingly different for services than for manufacturing. This suggests that, in terms of the dynamics of industrial organization, services may, in fact, not simply mirror the manufacturing sector.

2. Measurement

One of the main reasons why so little is known about the dynamics of industrial organization outside of manufacturing is the paucity of comprehensive longitudinal data bases for non-manufacturing firms. All of the pioneering studies examining the dynamics of industrial organization in terms of the entry of new firms, their subsequent survival and growth or exit, have been based on longitudinal data in manufacturing.

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[1] The combination of the Statistical Regularities 1 and 2 in Sutton (1997) is consistent with both the observed positive relationships between the likelihood of survival and firm size and age, and the observed negative relationships between firm growth and age and size, which are the basis for Geroski to constitute his Stylized Result 8 (Geroski, 1995). The Statistical Regularities 1 and 2 in Sutton (1997, p. 46) are:

1. *Size and Growth*: (a) the probability of survival increases with firm (or plant) size. (b) the proportional rate of growth of a firm (or plant) conditional on survival is decreasing in size.

2. *The Life Cycle*: For any given size of firm (or plant), the proportional rate of growth is smaller according as the firm (or plant) is older, but its probability of survival is greater.

In this paper we use firm level data for the services for the period 1985-1988 in the Dutch hospitality and retail sectors. Data were compiled in a yearly survey undertaken by Statistics Netherlands (CBS) in the files, *Statistics of Man-Years and Gross Wages*. Annual observations for each non-manufacturing firm include the number of employees,[2] the year the firm was started,[3] the municipal location, the four-digit industry code (SBI), the legal form and a firm identifier.[4]

Entrants in any year t are defined as those firms that appeared in the data set in that year for the first time. Conversely, exit in year t is measured as those firms that appear in the data set in year t-1 but not in year t. Incumbents are defined as firms that remained in the data set over the entire observation period.

There are three important qualifications about the data base that should be emphasized. First, entry and exit rates overestimate the turnover of firms. This is because only firms with employees are included in the data base. This means that when a firm has an employee in one year but no employee(s) in the subsequent year, the firm is classified as exiting, when it may still be in operation. This overstatement of exit and entry is greater for small firms than for larger enterprises.

Second, the start-up year is measured as the year that a firm appears for the first time in the *Algemeen BedrijfsRegister*, or the General Business Register (ABR).[5] It is certainly possible firms existed before they were registered in the ABR and may be older than are actually recorded.

Finally, the four-digit industry code associated with a firm can change during the observation period. For example, as a result of a (typically slight) change in the share of sales from beverages to meals, the four-digit industry of a firm in the hospitality sector can be changed from cafes to restaurants. In addition, the four-digit industry code for some firms can only be determined correctly after several years of business activities. In such cases the firm is classified as neither exiting nor entering. If the four-digit industry code changes during the observation period the firm is assigned to the industry where it was recorded most recently.

The data base provides longitudinal observations for 66 four-digit retail industries and 13 hospitality industries. For presentation purposes the 66 four-digit industries in retailing are condensed into 18 slightly broader three-digit industries in Table 1, which lists the number of firms, employment and mean employment size for each industry. The mean firm size in services is remarkably small – the average size of the 44,499 retail firms is 7.5 employees, and of the 18,423 hospitality firms is 4.8 employees.

Insert Table 1 here

3. Geroski's Stylized Facts: Are the Services Different?

The first Stylized Fact Geroski (1995, p. 422) draws attention to in his review of the literature on industry dynamics in manufacturing is "Entry is common. Large numbers of firms enter most markets in most years, but entry rates are far higher than market penetration rates."[6] Table 2 confirms that entry is also important for services. The mean entry rate for the 1985-1988

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[2] For each firm the number of working days of paid employees is known. For each firm we divided the number by 260. In this way, for each firm, the number of (paid) employees, measured in full-time equivalents (FTE), is obtained.

[3] This is actually the initial year that the firm was registered with Statistics Netherlands.

[4] More details about the data set can be found in chapters 3 and 4 of Klomp (1996).

[5] In principle the ABR includes all firms in the Netherlands. The ABR is more fully described in Willeboordse (1986).

[6] There are, in fact, more Stylized Facts provided by Geroski (1995) than we are able to compare with in this paper due to the broad range of subjects that he covers. The relevant Stylized Facts which we deal with are Stylized Facts 1, 3 and 4, along with Stylized Result 8.

period is 21 percent in retailing and 27 percent in hospitality.[7] These entry rates for Dutch services also exceed the entry rates found by Dunne, Roberts and Samuelson (1988 and 1989) for United States manufacturing.[8] Compared to the findings of Kleijweg and Lever (1994) documenting the role of entry in Dutch manufacturing, entry in services in the Netherlands is at least as important.

In addition, the market penetration of new entrants, measured as the market share of employment of new firms, i.e., new firm employment divided by total industry employment, is considerably less than the entry rates. The market penetration rate is 9.8 percent in retailing, which is less than half as large as the entry rate. Similarly, the market penetration rate is 18.0 percent in the hospitality sector, which is 50 percent less than the entry rate. Thus, the low market penetration rates of new entrants relative to the entry rates in services is similar to Geroski's Stylized Fact for manufacturing.

The third Stylized Fact uncovered by Geroski (1995) is "Entry and exit rates are highly positively correlated, and net entry rates and penetration are modest fractions of gross entry rates and penetration."[9] The exit rates shown in the second column of Table 2 tend to follow the entry rates in the first column.[10] Those service industries with a low entry rate also tend to experience a low exit rate; those service industries with a high entry rate also tend to experience a high exit rate. This is consistent with the simple correlation coefficient of 0.52 between entry and exit rates across industries. This high degree of correlation found between entry and exit in services is also consistent with that found for manufacturing, not just in the Netherlands (Kleijweg and Lever, 1994), but also in a host of other countries, such as the United States (Dunne, Roberts and Samuelson, 1988), Portugal (Mata, 1993), Germany (Wagner, 1994), and Canada (Baldwin, 1995).

The net entry rates, or the difference between the gross entry rate and the exit rate, is relatively small in the Dutch services and certainly smaller than the gross entry rates as well as the penetration rates. The mean net entry rate in retailing is -3.2 percent, which is considerably smaller than the gross entry rate of 21.1 percent. Similarly, the mean net entry rate in hospitality is 3.0 percent, which is considerably smaller than the gross entry rate of 27.0 percent. The net penetration rates, or the difference between the penetration rate of the entrants and that of the exiting firms, which is shown in the third and fourth columns, is also considerably smaller than the penetration rates of the entrants. Thus, the tendency for gross entry to exceed net entry and for gross penetration by entrants to exceed the net penetration holds for services as well as in manufacturing.

Insert Table 2 here

The fourth Stylized Fact regarding industry dynamics for manufacturing uncovered by Geroski is, "The survival rate of most entrants is low, and even successful entrants may take more than a decade to achieve a size comparable to the average incumbent." This Stylized Fact also holds for services, as indicated in Table 3, which shows the exit rate, market share, and relative

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[7] The entry rate is based on Dunne, Roberts and Samuelson (1988 and 1989) and is defined as the number of firms entering the industry between 1986-1988 divided by the total number of firms in that industry in 1985.

[8] See Carree and Thurik (1996) for an extensive review of the empirical literature on the entry and exit of firms.

[9] This Stylized Fact by Geroski is very similar to (the first part of) Sutton's fourth Statistical Regularity (Sutton, 1997, p. 52) which is:

4. *Turbulence*: Across different industries, there is a positive correlation between gross entry rates, and gross exit rates, i.e., the "churning" of the population of firms is greater in some industries than others. However, most of this entry and exit has relatively little effect on the largest firms in the industry.

The last sentence of Statistical Regularity 4 by Sutton is consistent with Geroski's fourth Stylized Fact, which we discuss below.

[10] The exit rate is based on Dunne, Roberts and Samuelson (1988 and 1989) and is defined as the number of firms exiting the industry between 1986-1988 divided by the total number of firms in that industry in 1985.

size by firm age class. The mean three-year exit rate in retailing declines with age, from 39.6 percent for firms two years old and younger, to 18.9 percent for firms that are at least 11 years old. Similarly, the mean exit rate in hospitality also declines with age, from 37.5 percent for firms two years old and younger, to 15.0 percent for firms that are at least 11 years old.

Table 3 also shows that the mean size of firms in an age class relative to the size of all firms in the industry is greater for older firms than for younger firms. The mean size of firms is defined as the number of employees in the industry divided by the number of firms. Retail firms that are at least 11 years old are, on average, 31 percent larger than the industry mean size. By contrast, retail firms that are between 6 and 10 years old are only 54.9 percent as large as the industry mean size. One surprising finding that differs from that in manufacturing is that the youngest firms in retailing are actually slightly larger than the mean firm size for the entire industry. But this may be the result of the large size of new firms in industry 652, potatoes, fruit, vegetables, beverages, chocolate and tobacco. By contrast, in hospitality, the youngest firms are only 61.6 percent as large as the mean firm size in the industry. Even firms that are between six and ten years old are only 81.9 percent as large as the mean firm size for the entire industry. Firm size only starts to increase significantly for firms that are at least 11 years old, which have a mean size of 77.6 percent greater than that for the entire industry. Thus, not only does the likelihood of survival tend to be low in services, but older firms tend to be larger than their younger counterparts, in a manner that is similar to that found in manufacturing.

Insert Table 3 here

Based on three of the Stylized Facts about entry and subsequent post-entry performance that Geroski was able to uncover from a large and diverse body of studies for the manufacturing sector, the evidence presented here suggests that these Stylized Facts tend to hold up quite well for the services. That is, the entry of new firms is common and involves a high number of entrants, but the market penetration of those new entrants is considerably lower than the actual entry rates. In addition, entry rates tend to be highly correlated with exit rates. Finally, the likelihood of new-firm survival is low in services, just as it is in manufacturing.

4. Why Are Services Different?

Despite the seeming similarities in the dynamics of new-firm entry and their post-entry patterns between services and manufacturing documented in the previous section, there are theoretical reasons to believe that, in fact, the services would not be expected to mirror manufacturing, particularly with respect to the central focus of the literature on the post-entry performance of firms --- growth and survival. Beginning with the pioneering studies by Evans (1987a and 1987b) and Hall (1987) along with Dunne, Roberts and Samuelson (1988 and 1989) a central finding of this literature is that firm growth is negatively related to firm size and age and that firm survival is positively related to size and age. These findings have been confirmed in virtually every other study undertaken, despite differences in country, time period and methodology used, leading Geroski (1995, p. 434) to infer the existence of a Stylized Result that “Both firm size and age are correlated with the survival and growth of entrants.”

Despite the robustness of this Stylized Result for manufacturing, there are strong theoretical reasons why it may not hold for services. The reason for this doubt comes from a secondary result about the relationships between growth and survival on the one hand and firm size and age on the other from the manufacturing industries. While these relationships have been found to hold for manufacturing firms in general, studies find that they actually vary systematically across industries, depending upon particular characteristics specific to each industry. In particular, the likelihood of new-firm survival is found to be systematically lower in industries where scale economies play an important role and systematically higher in industries with no significant economies of scale. Similarly, the growth of new firms is found to be greater in those industries with high scale economies but lower in industries where scale economies are negligible.

Why should the extent of scale economies influence the likelihood of survival and post-entry growth? The answer provided by Jovanovic (1982), which presents the common theoretical framework for this literature, has to do with the conditions under which people start firms. In his theory of noisy learning, Jovanovic (1982) argues that new firms are started by entrepreneurs who have limited knowledge about their ability to manage a firm and therefore about the viability of the new start-up[11]. Although entrepreneurs may start a new firm based on an expected post-entry performance, they only discover or learn about their true ability on the basis of actual firm performance. Those entrepreneurs who discover that their ability exceeds expectations expand the scale of operations, while those who are disappointed are unable to grow.

But what happens to those new firms unable to grow? If scale economies are negligible in the industry, the firm can remain operating at a small scale of output indefinitely without incurring any cost disadvantage. However, if there are extensive economies of scale, a small firm will be confronted by sizeable cost disadvantages. The inability of the new firm to grow will force it to exit from an industry characterized by high scale economies but not in industries with negligible scale economies. At the same time, any cost disadvantage resulting from scale economies will be reduced as the firm size increases. As the empirical evidence in manufacturing suggests, the likelihood of new-firm survival tends to be lower but growth rates of surviving new firms higher in industries where scale economies are substantial (Audretsch, 1995; Baldwin, 1995; Mata, 1994; Audretsch and Mahmood, 1995; and Wagner, 1994). The consequences of not being able to grow and attain the minimum efficient scale (MES) are a cost disadvantage which will ultimately lead to exit.

The different impacts of size and age on growth and survival across different industries is also evidenced from the disparities in the empirical findings on the validity of Gibrat's Law, which assumes that firm growth is independent of size, between samples of smaller firms and larger firms. At first glance, the empirical evidence testing the validity of Gibrat's Law seems ambiguous and confusing. For example, Schmalensee (1989) concludes that Gibrat's Law seems to hold in older studies but not in newer studies. But what differs between the older and more recent studies is the size composition of firms included in the data base. In fact, most studies consisting of larger firms, which tend to be the older studies, have found Gibrat's Law to hold. Growth appears to be independent of size for large firms. But the evidence is strikingly different for studies including small firms. As Geroski (1995) characterizes as a Stylized Result from these studies, firm size tends to be negatively correlated with growth. Actually Mansfield (1962) anticipated the reconciliation between these seemingly inconsistent results when he warned that Gibrat's Law should only hold for firms having attained the MES level of output. Those firms operating at a sub-optimal scale of output need to grow in order to survive, resulting in the observation of a negative relationship between growth and firm size but a positive relationship between survival and firm size.

One of the main differences between services and manufacturing, at least in the Netherlands, is the absence of scale economies in services. There has been a long and vibrant tradition of small-scale enterprise in the Dutch services. As Table 1 suggests, the Dutch are an economy of small shopkeepers when it comes to services, at least up until now. Clearly, this is consistent with the observation from Table 1 of the mean employment size of fewer than eight employees in retailing and fewer than five employees in hospitality. While these averages include incumbents as well as new firms, the mean size of just ***start-ups*** in manufacturing has been found to be slightly greater in OECD countries as diverse as the U.S. (Dunne, Roberts and Samuelson,

[11] Recent extensions of the Jovanovic model can be found in Hopenhayn (1992) and Ericson and Pakes (1995).

1988), Germany (Wagner, 1994), Canada (Baldwin, 1995) and Portugal (Mata and Portugal, 1994).

The relative absence of scale economies in the Dutch services imply a different selection process for new firms in the services than has been found in manufacturing. New entrants are not compelled to grow in order to survive. Negligible scale economies in services ensure that new firms can remain small without being confronted by any cost disadvantage. In the absence of any pressure to grow in order to reduce costs, no systematic relationships would be expected to be found between growth and survival on the one hand and firm size and age on the other. What is currently referred to as a Stylized Result in the literature may only apply to manufacturing but not services.

We expect that growth rates for services are distributed more or less independently of firm size and age. We do not expect to observe a relationship between the likelihood of survival and firm size either. However, since the learning process described by Jovanovic (1982) should be as valid in services as it is in manufacturing, we would expect the likelihood of survival to increase with age. These four propositions are tested in the next section.

5. Linking Growth and Survival to Firm Size and Age

While there have been numerous methodologies and frameworks used to link firm growth to size and age, and survival to size and age in the studies of manufacturing, to examine these relationships for services we adapt not only the methodology, but also the exact functional form, used in the pioneering studies by Evans (1987a and 1987b).[12] Firm growth, G, is determined by size, S, and age, A, in a second-order expansion in a (natural) log specified model,

$$\ln G_{t'} = [\ln S_{t'} \mid \ln S_t] / d = \beta_0 + \beta_1 \ln S_t + \beta_2 \ln A_t + \beta_3 (\ln S_t)^2 + \beta_4 (\ln A_t)^2 + \beta_5 (\ln S_t) \times (\ln A_t) + u_t \quad (1)$$

where the annual firm growth rate, G, is measured by the number of employees in 1988 divided by the number of employees in 1985 and divided by 3. Firm size is measured as the number of employees in 1985,[13] and age is the number of years the firm has been in operation in 1985.[14] The time period t, refers to 1985 and t' refers to 1988, so that $t' \geq t, d = t' - t$, and u is a normally distributed disturbance term with mean zero and possibly nonconstant variance across observations.

Survival is similarly estimated by

$$E[I_{t'} \mid A_t, S_t] = \Phi[\gamma_0 + \gamma_1 \ln S_t + \gamma_2 \ln A_t + \gamma_3 (\ln S_t)^2 + \gamma_4 (\ln A_t)^2 + \gamma_5 (\ln S_t) \times (\ln A_t)] \quad (2)$$

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[12] A linear functional form (which Evans (1987a and 1987b) did not estimate), was also estimated but the results are not reported here because inclusion of the quadratic terms substantially increases the fit of the model.

[13] There is a difference in the measurement of the employment size between incorporated and non-incorporated firms. This discrepancy occurs because non-incorporated firms do not include the owner as being employed, while the managing director of an incorporated firm is. We reconcile this discrepancy by increasing the number of recorded employment in unincorporated firms by one. Because some incorporated firms with only part-time employees are sufficiently small to have full-time equivalent (FTE) employment of less than one, they are excluded from the data base.

[14] To avoid having undefined observations when taking the log of the age of new firms, the age of each firm is augmented by one year. In addition, the age of the firm tends to be somewhat underestimated as a result in the lag between the start-up date and the time the firm is recorded in the data base. An approximation about the age of old firms had to be made since the General Business Register (ABR) started in 1967, so that no firm births were

where $E[I_{t'}|A_t, S_t]$ is the conditional expectation of survival I given the size and age in period t, $I_{t'}=1$ if a firm survives from 1985 through 1988, $I_{t'}=0$ if a firm exits between 1985 and 1988, and Φ is the cumulative distribution for a (standard) normal variable. We obtain estimation results for firm survival in the probit equation (2) using the maximum likelihood (ML) method. The estimation of the growth equation (1) can not be carried out in a straightforward manner. As a result of sample selection and heteroscedasticity, the estimation needs to be corrected to obtain unbiased coefficients in equation (1). We shall first discuss these issues of sample selection and heteroscedasticity.

There have been two main sources of sample selection bias in the studies linking firm survival and growth to size and age in manufacturing. First, sample selection has occurred because large firms are overrepresented in the data set.[15] Larger firms in many of the studies have a higher probability of being selected in the data base than smaller firms. This source of sample selection is not likely to impose a bias on the data base used in this study because all firms with paid employees are included in the data base: all small and large firms have an equal chance of being included in the data base, which in principle, should be 100 percent. The second source of selection bias in most studies occurs because growth can only be observed and measured for surviving firms. Since virtually every study for manufacturing finds that survival is positively related to size and age, the estimated relationships between firm growth and size and firm growth and age will be biased downwards.[16] We estimate the probit equation (2) and add Heckman's l (Heckman, 1979) to equation (1) to correct for sample selection bias.[17]

There is a complication involved in adding Heckman's l to equation (1). First, inclusion of the variable l causes severe multicollinearity in the growth equation. The variable l is a non-linear function of the independent variables in the survival equation, which are the same as those in the growth equation. The introduction of l results in imprecise estimates of the coefficients in the growth equation. Therefore, we estimate the probit equation for each of the 18 three-digit retail industries and for each of the 5 four-digit hospitality industries, as defined in Table 1. We then use the coefficients of the industries to calculate the variable l.[18]

If the growth rates of firms vary less for larger and older firms it is reasonable to expect heteroscedasticity in the growth equation (1). We follow White's (1980a) procedure and regress the squared residuals upon the regressors used in equation (1),[19] and afterwards the squared estimated residuals are used to obtain weighted least squares (WLS) results.[20]

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recorded prior to 1967. The estimated age of firms born before 1967 is based on fitting a lognormal distribution of the age data. The approximated mean firm age for these older firms in 1985 is 27 in hospitality and 31 in retailing.

[15] Mata (1994) points out that this form of sample selection bias has occurred in most of the studies in manufacturing linking firm survival and growth to age and size.

[16] Mansfield (1962) implicitly introduced the possibility of sample selection bias by conjecturing that the inverse relationship between firm growth and size is an artefact of the greater likelihood of exit exhibited by slow-growth firms. Evans (1987a and 1987b) and Hall (1987), as well as subsequent studies, found that the observed negative relationship between growth and firm size is robust with respect to sample censoring.

[17] If the coefficient for the variable l differs significantly from zero, the standard errors for all coefficients in equation (1) are understated. We followed the procedure suggested by Heckman (1979) and corrected by Greene (1981) to obtain consistent estimates of the standard errors.

[18] The use of the coefficients of the three- and four-digit industries to calculate the variable l reduces the value of the R^2 between the variable l and the (five) other independent variables from 0.999 to 0.833 in the retail sector and from 1.000 to 0.919 in hospitality.

[19] We do not include third-order expansion terms in the regression due to strong multicollinearity.

[20] The degree of heteroscedasticity is modest and the OLS and WLS estimates are close, although the OLS estimates generally do not pass the White (1980a) test. The slight differences between the OLS and WLS estimates indicate that no further nonlinearity than the second-order expansions in equation (1) is needed. See White (1980b).

The estimated results of equations (1) and (2) are presented in Table 4 based on 45,158 firms in retailing and 17,610 firms in hospitality. Estimation of quadratic relationships make it difficult to unequivocally interpret whether an explanatory variable has a positive or negative impact. Only by calculating the turning point and then the number of firms included in each part of the curve can such an inference be made. The results of such calculations are given in Table 5, which shows the share of firms included in the increasing and decreasing parts of the functions.[21]

In the growth equations for retailing, the negative coefficient of firm size combined with the positive coefficient of size-squared suggests that growth rates tend to decline as firm size increases up to a certain size and then increases with subsequent increases in firm size. As Table 5 shows, 91.6 percent of the firms are operating on the negative part of this curve; only the largest 8.4 percent of the firms have a sufficient size to be operating on the positive part of the curve.[22] This means that for almost all firms in retailing firm growth declines with size.

Similarly, the negative coefficient of age combined with the positive coefficient of age-squared suggests that age has a negative impact on growth for smaller firms but a positive impact for larger firms. As Table 5 shows, 82.7 percent of the firms are operating on the negative part of this curve and only the largest 17.3 percent are on the positive part. This means that all but the largest of the retail firms experience a negative relationship between firm growth and age.

Thus, the results from estimation equation (1) for all retail firms imply that the relationships between firm growth and size, and growth and age are similar to those that have emerged in manufacturing. The finding of generally negative relationships between growth on the one hand, and size and age on the other are independent of whether the estimated growth equation is corrected for sample selection bias.

The probit estimation of survival for all retailing firms results in a positive coefficient between firm size and the likelihood of survival but a negative coefficient between firm-size squared and the likelihood of survival. This suggests that the likelihood of survival increases with firm size up to a point and then decreases with subsequent increases in firm size. As Table 5 shows, 97.8 percent of the retail firms operate in the upward sloping part of this curve; only 2.2 percent of the retail firms are actually in the downward sloping part of this curve. The vast majority of retail firms are subject to a positive relationship between firm size and the likelihood of survival.

Similarly, the positive coefficient of age combined with the negative coefficient of age-squared implies that the likelihood of survival increases as firms mature until a critical age and then decreases as the firm ages. Table 5 shows that 91.0 percent of the retail firms are on the upward slope of this curve, while only 9.0 percent are on the downward slope.

Table 4 also shows virtually identical results for the hospitality firms. In particular, 94.5 percent of the firms are found to experience negative relationships between firm size and growth and 80.3 percent between firm size and age. Similarly, 97.9 percent of the firms are found to experience a positive relationship between the likelihood of survival and firm size, while all the firms experience a positive relationship between the likelihood of survival and firm age. Thus, the generally positive impact of size and age on the likelihood of firm survival in both hospitality as well as retailing seems to mirror the Stylized Result found in manufacturing.

Insert Tables 4 and 5 here

The previous section predicts that, based on the findings from manufacturing industries, the impacts of age and size on growth and survival should be lower or even non-existent for firms

[21] The impact of size and age on firm growth and survival is calculated by computing the partial derivatives of (logarithmic) growth and survival with respect to (logarithmic) size and (logarithmic) age.

[22] These calculations are based on the estimated regression for firm growth in Table 4 using weighted least squares (WLS) and corrected for sample selection bias.

that have attained the MES level of output.[23] This suggests that the results from Table 4 may be sensitive to inclusion of the smallest firms in the sample.[24] The prevalence of small-scale operations in the Dutch services suggest a virtual absence of scale economies in all but the tiniest enterprises. Thus, we re-estimate the growth and survival equations leaving out firms with fewer than five employees. The results, which are reported in Table 6, are strikingly different when the smallest firms are omitted. While the sign of the coefficients in the growth equations are the same as in Table 4, their impacts are considerably weaker. For the hospitality industries there is no significant relationship between growth and the size and age of firms when the smallest firms are omitted from the sample. None of the coefficients of size and age in the growth equations in hospitality are statistically significant. For retailing, the coefficients of size and age are statistically significant (at the 5 percent level), but are sufficiently small as to render the impact of size and age on growth meaningless. Using the F-test proposed by Leamer (1978) leads to the conclusion that growth rates are independent of size and age, even in the retail industries.[25] In addition, the growth equation the R^2 for retailing falls from 0.0645 in Table 4 to 0.0109 in Table 6, and in hospitality from 0.0600 in Table 4 to 0.0035 in Table 6.

To ensure that these results do not reflect the aggregation of firms from different industries, the growth equations were estimated for each of the 16 retail three-digit industries and 5 hospitality industries. Using a 1 percent level of significance, the hypothesis that there are no size and age effects is accepted in 15 of the 16 retail industries, and in 4 of the 5 hospitality industries.

The results from the probit survival estimates in Table 6 also show that firm survival is not related to size in either retailing or hospitality. The coefficients of size and size-squared are not statistically significant in either of these service industries. However, as the statistically significant coefficients of age suggests, the likelihood of survival is still shaped by firm age, even when the smallest firms are deleted from the sample. On average, a one percent change in age leads to a 0.064 percent change in the probability of survival in retailing, and a 0.075 percent change in the likelihood of survival in hospitality.[26]

Insert Table 6 here

To summarize the results of growth and survival, the four propositions stated at the end of the previous section have been largely confirmed. In particular, the results when the smallest service firms are omitted in Table 6 are strikingly different from the Stylized Result reported by Geroski (1995) based on manufacturing. Firm growth is not systematically related to either size or age. Rather, Gibrat's Law holds for all but the smallest of firms in the services, suggesting that firm growth is independent of size. While Evans (1987a, p. 579) concluded that in manufacturing "firm growth decreases at a diminishing rate with firm size," the evidence from services suggests that Gibrat's Law actually holds in the services for all but the tiniest firms. Similarly, the likelihood of survival is independent of size for all but the smallest service firms. Unlike in manufacturing, beyond just a handful of employees, additional increases in firm size will neither influence growth

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[23] An important characteristic of hospitality and retailing in the Netherlands is the absence of significant scale economies.

[24] One reason for this is due to statistical problems associated with regression to the mean. As Mata (1994) points out, firms with no or just several employees cannot experience a measured decrease in employment growth. If such a tiny firm experiences negative growth, it will, by definition, disappear. Therefore, the lower bound of measured growth rates for firms with no employees is zero percent and cannot, by definition, be negative. Only firms with more than a handful of employees can experience negative growth and still be in existence.

[25] The calculated F-values for the hypotheses that there are no age and size effects on growth are 6.89 and 5.98, respectively. The critical F-value is 9.13 for the retail industries.

[26] The average elasticities of firm survival with respect to age in Table 6 approximate those from Table 4, which are reported in Table 5. The higher age of the firms included in the samples used in Table 6 compared to that in Table 4 offsets the higher coefficients for the age and size variables in Table 6 compared to those in Table 4.

nor secure a higher likelihood of survival. Of all four relationships involved in Geroski's Stylized Result based on manufacturing, only the link between age and survival is found to hold for services.

6. Conclusions

Are the services different from manufacturing? The answer is somewhat ambiguous. On the one hand, the relationships between firm survival, growth, age and size, which have emerged so consistently in manufacturing as to constitute a Stylized Result (Geroski, 1995) or Statistical Regularities (Sutton, 1997), do not exist in the services for all but the smallest firms. The post-entry dynamics appear to be strikingly different in services than in manufacturing.

On the other hand, further reflection suggests that firms in services are subject to the same selection process as their manufacturing counterparts. As Jovanovic (1982) indicated, entrants need to learn about the viability of their new enterprise. The positive impact of age on the likelihood of survival in both services as well as manufacturing argues that in the initial post-entry period new start-ups have a high propensity to exit, presumably because they learn that their new venture is not feasible.

In addition, firms with only a handful of employees are found to be confronted with a lower likelihood of survival in the services, just as in manufacturing. And, those tiny service firms that do manage to survive have systematically higher growth rates than do their larger counterparts. Just as has been found in manufacturing, these tiny service firms need to grow in order to survive. This pressure, however, is lower than in manufacturing. Apparently, this necessity to grow disappears once the service firms have reached the size of five employees.

What is different in services than manufacturing is the apparent absence of scale economies, so that the role of size in the selection process of new entrants diminishes quickly and disappears once the minimal size of about five employees has been attained. By contrast, the mean start-up size in manufacturing is considerably larger than five employees. The differences between services and manufacturing found in this paper were in some way anticipated by Mansfield (1962), even before any of the empirical studies on post-entry performance of firms were undertaken. Mansfield emphasized that the assumption of Gibrat's Law, that growth is independent of size, should hold only for firms that have attained the MES level of output and exhausted scale economies. Sub-optimal scale firms need to grow in order to attain the MES level of output and reduce average cost to a minimum. By contrast, large firms experiencing even negative growth will not be penalized by a cost disadvantage. Much of the ambiguities in the literature on Gibrat's Law are attributable to neglecting Mansfield's distinction about the role of scale economies in shaping the firm size-growth relationship some three decades ago.

The suggestion that the dynamics of industrial organization in services mirrors that in manufacturing appears naïve and is not supported by the evidence. Therefore, what emerges as a Stylized Fact in manufacturing may not hold in services. The evidence from this paper suggest that services, at least in the European context, differ from manufacturing in that scale economies are negligible, resulting in a different post-entry performance in the services than in manufacturing. Of course, Europe remains a continent where family-owned pensions have not yet been replaced by large hotel chains and where local independent restaurants and retail stores have not yet been overtaken by national and international mega-store chains. Whether our findings would hold in the very different context of North America can only be confirmed by undertaking the necessary research.

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Table 1 Description of the retail and hospitality industries for the year 1988

SBI[1]	Industry	No. of Firms	Employment (thousands)	Employment per firm
65/66	*Retail trade (total)*	*44499*	*332.0*	*7.5*
651	Meat, fish, poultry and dairy products	5498	17.8	3.2
652	Potatoes, fruit, vegetables, beverages, chocolate and tobacco	7720	105.9	13.7
653	Pharmacies	1106	9.8	8.9
654	Medical and orthopedic goods, perfumery and toilet articles	1445	7.3	5.0
655	Clothing	4995	38.3	7.7
656	Textiles, wool, linen and dress materials	1273	9.2	7.3
657	Footwear, leather goods and travel accessories	1517	11.2	7.4
658	Floor covering and furnishing fabrics	1983	9.7	4.9
659	Domestic decoration and electric household appliances	3409	19.4	5.7
661	Household utensils and do-it-yourself materials	3410	19.8	5.8
662	Cars, motor-cycles and bicycles	2285	10.4	4.6
663	Gas stations	1280	5.5	4.3
664	Books, newspapers and magazines	1213	7.7	6.3
665	Photographic and optical equipment, watches and jewellery	2217	9.4	4.3
666	Flowers, plants and pets	3103	7.5	2.4
667	Fuel oil, bottled gas, coal and wood	121	0.4	3.7
668	Games and toys, sports goods, camping articles and caravans	1781	7.2	4.0
669	Department stores and mail order houses	143	35.3	246.8
67	*Hospitality (total)*	*18423*	*88.4*	*4.8*
6711	Restaurants	5455	27.3	5.0
6712	Cafeterias	3959	9.9	2.5
6721	Cafes[2]	5715	12.8	2.3
6741	Hotels	1595	22.0	13.8
6799	Remaining hospitality industries	1699	16.3	9.6

1 For the SBI-code the 'Standaard BedrijfsIndeling' of the Central Bureau of Statistics (CBS) of 1974 is used.
2 The business group of cafes include both firms which do and do not have a licence to serve wines and spirits.

Table 2 Measures of entry, exit, their market shares and relative size in services

	Entry	Exit	Market Share		Relative Size	
	Rates	Rates	Entry	Exit	Entry	Exit
SBI						
Retailing						
Total	*0.211*	*0.243*	*0.098*	*0.179*	*0.399*	*0.679*
651	0.161	0.234	0.193	0.253	1.130	1.109
652	0.189	0.265	0.079	0.119	0.333	0.373
653	0.125	0.115	0.147	0.142	1.214	1.276
654	0.148	0.190	0.097	0.203	0.589	1.083
655	0.235	0.246	0.098	0.122	0.352	0.498
656	0.212	0.348	0.074	0.153	0.247	0.337
657	0.152	0.202	0.139	0.162	0.842	0.764
658	0.158	0.216	0.101	0.148	0.540	0.630
659	0.259	0.265	0.110	0.153	0.358	0.500
661	0.245	0.272	0.116	0.136	0.391	0.422
662	0.267	0.224	0.162	0.145	0.565	0.588
663	0.197	0.205	0.150	0.127	0.705	0.563
664	0.238	0.216	0.128	0.274	0.482	1.366
665	0.173	0.210	0.118	0.135	0.611	0.588
666	0.305	0.230	0.149	0.168	0.439	0.679
667	0.118	0.250	0.049	0.157	0.318	0.562
668	0.328	0.295	0.125	0.201	0.309	0.599
669	0.140	0.280	0.016	0.413	0.089	1.808
Hospitality						
Total	*0.270*	*0.240*	*0.180*	*0.136*	*0.617*	*0.499*
6711	0.214	0.199	0.141	0.113	0.623	0.515
6712	0.330	0.260	0.227	0.161	0.654	0.546
6721	0.337	0.290	0.215	0.173	0.578	0.513
6741	0.115	0.144	0.113	0.097	0.927	0.634
6799	0.247	0.257	0.279	0.180	1.129	0.631

Table 3 Exit rate, market share and relative size by age class

	Exit Rate by Age class (years)				Market Share[1] by Age class (years)				Relative Size[2] by Age class (years)			
	0-2	3-5	6-10	11+	0-2	3-5	6-10	11+	0-2	3-5	6-10	11+
SBI												
Retailing												
Total	*0.396*	*0.316*	*0.265*	*0.189*	*0.081*	*0.093*	*0.171*	*0.655*	*1.088*	*0.804*	*0.549*	*1.313*
651	0.406	0.330	0.261	0.172	0.035	0.124	0.240	0.601	0.477	1.201	0.736	1.209
652	0.404	0.303	0.281	0.225	0.139	0.112	0.134	0.615	1.823	0.954	0.424	1.254
653	0.173	0.094	0.130	0.100	0.069	0.098	0.237	0.596	0.593	0.716	1.047	1.145
654	0.518	0.233	0.204	0.162	0.018	0.032	0.363	0.587	0.486	0.541	1.448	0.899
655	0.411	0.346	0.275	0.169	0.084	0.085	0.134	0.698	0.817	0.597	0.523	1.396
656	0.500	0.487	0.355	0.255	0.029	0.325	0.197	0.449	0.259	2.499	0.560	1.107
657	0.311	0.252	0.243	0.169	0.021	0.078	0.164	0.737	0.372	0.958	0.656	1.203
658	0.383	0.311	0.226	0.178	0.061	0.106	0.156	0.677	1.030	0.974	0.659	1.137
659	0.418	0.435	0.295	0.207	0.050	0.120	0.217	0.613	0.715	1.065	0.672	1.240
661	0.385	0.351	0.301	0.220	0.034	0.079	0.196	0.691	0.508	0.654	0.640	1.364
662	0.343	0.326	0.260	0.173	0.018	0.069	0.237	0.667	0.585	0.665	0.698	1.285
663	0.243	0.211	0.259	0.153	0.048	0.079	0.301	0.571	0.848	0.700	0.787	1.277
664	0.402	0.312	0.266	0.143	0.022	0.057	0.234	0.688	0.281	0.430	0.934	1.273
665	0.318	0.287	0.233	0.173	0.071	0.062	0.213	0.654	0.942	0.797	0.741	1.156
666	0.406	0.247	0.229	0.186	0.030	0.093	0.382	0.495	0.400	0.687	0.873	1.405
667	n.a.[3]	n.a.[3]	0.236	0.254	n.a.[3]	n.a.[3]	0.547	0.397	n.a.[3]	n.a.[3]	1.095	0.854
668	0.525	0.404	0.265	0.220	0.047	0.097	0.273	0.583	0.510	0.591	0.727	1.584
669	0.333	0.235	0.186	0.329	0.106	0.010	0.046	0.838	0.690	0.090	0.169	1.803
Hospitality												
Total	*0.375*	*0.289*	*0.238*	*0.150*	*0.066*	*0.157*	*0.250*	*0.527*	*0.616*	*0.766*	*0.819*	*1.776*
6711	0.321	0.234	0.188	0.127	0.080	0.186	0.280	0.454	0.650	0.862	0.842	1.592
6712	0.358	0.316	0.248	0.178	0.082	0.197	0.338	0.383	0.789	0.851	0.812	1.571
6721	0.426	0.332	0.277	0.183	0.126	0.175	0.323	0.376	0.508	0.751	0.685	1.587
6741	0.278	0.180	0.161	0.115	0.047	0.086	0.203	0.664	0.729	0.806	0.780	1.168
6799	0.436	0.345	0.272	0.154	0.019	0.167	0.171	0.642	0.196	0.937	0.488	1.723

1 The market share of an age class in an industry is defined as the employment in that age class divided by the total employment in the industry.

2 The relative size in an age class of an industry is defined as the average size in that age class divided by the average size in that industry.

3 Not available due to the small number of firms in the age class.

Table 4 Empirical results for firm growth and firm survival (equations (1) and (2) are estimated for all firms)

	Retail Industries			Hospitality Industries		
	Firm Growth: WLS[1]	Firm Survival: ML[2]	Firm Growth: WLS and CSS[3]	Firm Growth: WLS[1]	Firm Survival: ML[2]	Firm Growth: WLS and CSS[3]
Variable						
ln S	! 0.1072 (0.0048)[4]	0.5840 (0.0323)	-0.0881 (0.0066)	-0.1399 (0.0086)	0.6703 (0.0521)	-0.1566 (0.0156)
ln A	! 0.1010 (0.0068)	0.3230 (0.0421)	! 0.0907 (0.0074)	! 0.1099 (0.0104)	0.2652 (0.0662)	! 0.1182 (0.0121)
$(\ln S)^2$	0.0163 (0.0008)	! 0.1294 (0.0048)	0.0124 (0.0012)	0.0179 (0.0020)	! 0.1368 (0.0098)	0.0206 (0.0030)
$(\ln A)^2$	0.0129 (0.0014)	! 0.0595 (0.0093)	0.0112 (0.0015)	0.0146 (0.0025)	! 0.0219 (0.0172)	0.0154 (0.0025)
(ln S)x (ln A)	0.0093 (0.0016)	0.0944 (0.0116)	0.0102 (0.0017)	0.0211 (0.0034)	0.0789 (0.0227)	0.0214 (0.0034)
Constant	0.2529 (0.0088)	! 0.3395 (0.0501)	0.1996 (0.0153)	0.2595 (0.0124)	! 0.3119 (0.0693)	0.3018 (0.0341)
Heckman λ	-----	-----	0.0546 (0.0127)	-----	-----	! 0.0430 (0.0323)
R^2	0.0640	0.0758[5]	0.0645	0.0585	0.0830[5]	0.0600
N	34519	45158	34519	13484	17610	13484

1 WLS stands for weighted least squares.
2 ML stands for maximum likelihood.
3 WLS and CSS stands for weighted least squares estimates which are corrected for sample selection bias.
4 Standard errors are given between parentheses.
5 R^2 is defined as the proportion of the variance of firm survival rates that is explained by the probit equation.

Table 5 The effects of firm size and age on growth and survival (statistics based on the estimation results of Table 4)

	Partial derivative	Retail Industries	Hospitality Industries
g_s	mean	! 0.031	! 0.061
	standard deviation	0.022	0.036
	fraction positive	0.084	0.055
	fraction negative	0.916	0.945
g_a	mean	! 0.019	! 0.024
	standard deviation	0.019	0.029
	fraction positive	0.173	0.197
	fraction negative	0.827	0.803
s_s	mean	0.159	0.169
	standard deviation	0.086	0.091
	fraction positive	0.978	0.979
	fraction negative	0.022	0.021
s_a	mean	0.038	0.069
	standard deviation	0.033	0.021
	fraction positive	0.910	1.000
	fraction negative	0.090	0.000
	Elasticity		
$ES_{t'}S_t$	mean	0.969	0.939
	standard deviation	0.022	0.036
$ES_{t'}A_t$	mean	! 0.019	! 0.024
	standard deviation	0.019	0.029
ESS_t	mean	0.227	0.244
	standard deviation	0.165	0.164
ESA_t	mean	0.053	0.096
	standard deviation	0.066	0.044

Note: g_s is the partial derivative of (logarithmic) growth with respect to (logarithmic) size in the preceding year.
g_a is the partial derivative of (logarithmic) growth with respect to (logarithmic) age in the preceding year.
s_s is the partial derivative of survival with respect to (logarithmic) size in the preceding year.
s_a is the partial derivative of survival with respect to (logarithmic) age in the preceding year.
$ES_{t'}S_t$ is the elasticity of size in a certain year with respect to size in the preceding year.
$ES_{t'}A_t$ is the elasticity of size in a certain year with respect to age in the preceding year.
ESS_t is the elasticity of survival with respect to size in the preceding year.
ESA_t is the elasticity of survival with respect to age in the preceding year.

Table 6 Empirical results for firm growth and firm survival (equations (1) and (2) are estimated for firms with at least 5 (full time) employees)

	Retail Industries			Hospitality Industries		
	Firm Growth: WLS[1]	Firm Survival: ML[2]	Firm Growth: WLS and CSS[3]	Firm Growth: WLS[1]	Firm Survival: ML[2]	Firm Growth: WLS and CSS[3]
Variable						
ln S	! 0.0274 (0.0125)[4]	0.1256 (0.0931)	! 0.0279 (0.0139)	! 0.0261 (0.0388)	0.0505 (0.2042)	! 0.0210 (0.0465)
ln A	! 0.0739 (0.0190)	0.8910 (0.1348)	! 0.0577 (0.0221)	! 0.0396 (0.0389)	0.6800 (0.2445)	! 0.0028 (0.0496)
$(\ln S)^2$	0.0024 (0.0013)	! 0.0024 (0.0101)	0.0026 (0.0014)	! 0.0005 (0.0060)	! 0.0285 (0.0284)	! 0.0010 (0.0072)
$(\ln A)^2$	0.0069 (0.0033)	! 0.0903 (0.0252)	0.0053 (0.0037)	0.0028 (0.0071)	! 0.1097 (0.0508)	! 0.0008 (0.0087)
(ln S)x (ln A)	0.0074 (0.0031)	! 0.0734 (0.0241)	0.0067 (0.0035)	0.0121 (0.0096)	0.0670 (0.0596)	0.0117 (0.0115)
Constant	0.1430 (0.0334)	! 0.3839 (0.2296)	0.1006 (0.0410)	0.0612 (0.0748)	0.0099 (0.4166)	! 0.0483 (0.1027)
Heckman λ	-----	-----	0.0655 (0.0296)	-----	-----	0.1914 (0.0878)
R^2	0.0116	0.0207[5]	0.0109	0.0012	0.0516[5]	0.0035
N	9166	10564	9166	2980	3341	2980

1 WLS stands for weighted least squares.
2 ML stands for maximum likelihood.
3 WLS and CSS stands for weighted least squares estimates which are corrected for sample selection bias.
4 Standard errors are given between parentheses.
5 R^2 is defined as the proportion of the variance of firm survival rates that is explained by the probit equation.