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Demography of the Firm: A Useful Metaphor?

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Abstract. Demography of the firm is an interdisciplinary research field of economics, sociology and economic geography. Although the name suggests otherwise, demographic input has been limited until recently. This article argues that the demographic viewpoint may lead to added value. The metaphor is relevant, not because firms are similar to biological creatures (they are not), but because there are significant parallels in the mechanisms of population change, as a result of selective processes of birth and death, as well as aging and internal change of incumbent firms. The nature of these change processes at the micro level has to be studied using theories from other disciplines, such as economics, sociology and geography; a situation quite similar to that of human demography. The article compares similarities and discrepancies between the processes of birth and death in firm and human populations, as well as the most important dimensions of population structure and change, e.g. age, period, and cohort. A main difference is that in addition to these familiar variables in human demography, firm size and growth, and economic activity are also major dimensions of the structure of firm populations. Because there are strong interactions between these variables, any demographic analysis, for instance to determine the age curve of mortality, should also take into account these variables.

Key words: disbanding, firm age, firm demography, firm size, founding

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Résumé. Le démographie des entreprises est un champ de recherche interdisciplinaire associant l'économie, la sociologie et la géographie économique. Contrairement à ce que suggère son intitulé, l'apport démographique y est jusqu'ici resté très limité. Le point de vue démographique pourrait pourtant contribuer à enrichir le domaine. La métaphore est justifiée non pas parce que les entreprises sont similaires à des créatures biologiques (elles ne le sont pas) mais parce qu'on retrouve des parallèles significatifs avec les mécanismes de changement démographique aussi bien en termes de naissances et décès qu'en termes de vieillissement et de restructuration des entreprises. La nature des processus de changement au niveau micro doit être analysée en recourant à des théories issues d'autres disciplines comme l'économie, la sociologie et la géographie, d'une façon équivalente à ce qui se fait en démographie humaine. Cet article compare les similitudes et les divergences qui existent entre les processus de naissance et de décès dans la population humaine et la population des entreprises, ainsi que les facteurs d'état et de mouvement les plus importants, à savoir l'âge, la

période et la génération. Une différence importante tient au fait qu'à côté de ces variables courantes en démographie humaine, la structure de la population des entreprises dépend également fortement d'autres facteurs tels que la taille et la croissance de l'entreprise ou l'activité économique. Comme il existe de fortes interactions entre les différents facteurs, toute analyse démographique, comme par exemple l'estimation d'une courbe de mortalité par âge des entreprises, devrait prendre en compte l'ensembles de ces variables.

Mots-clés: âge, création, démantèlement, démographie des entreprises, taille

1. Introduction

Firms come and go, just like people. Between the two existential events of founding and disbanding, they go through a number of stages in their life cycle. Demographers study these events of birth and death, as well as changes in stages in the life cycle of humans. The *demography of firms* is concerned with similar types of events in populations of firms and enterprises. This field of research has gained popularity in recent years, especially in organizational sociology (Carroll and Hannan, 2000). There is also a renewed interest in such fields as industrial organization (Caves, 1998), and regional science, as witnessed, for example, in the April 2000 special issue of the *Papers in Regional Science*: 'Spatial perspectives on firm demography' (Van Dijk and Pellenbarg, 2000). In this article, the main similarities and discrepancies between both forms of demography will be addressed. In particular, it is investigated whether the application of demographic concepts and tools to the study of firms gives added value over and above existing fields of studies of firm dynamics. If there is added value, the demographic metaphor is useful. Nevertheless, this metaphor should not be pursued for its own sake. There are large differences between human beings and firms, which makes the field of demography of the firm special. These similarities and differences will be highlighted here. Before embarking on that task, two other related issues are discussed. Firstly, some clarification of existing confusion about the name of the field is necessary. Secondly, demography of the firm has a multidisciplinary history. A brief overview is provided here, that puts the contributions of the various disciplines in perspective.

2. The name of the field

Common variants of the demography of firms are demography of organisations, business corporations, or enterprises. The term organization has a wider meaning than enterprise or firm, and includes non-economic institutions, such as labour unions, universities, and governmental agencies. The distinction between enterprises, firms and business units depends on the definitions. Commonly, a firm is organized around a production process, whereas an enterprise refers to a formal entity. Business units or establishments refer to a physical plant. The implications

of the differences between these definitions for the demography of the population may be large, but in practice, clear distinctions are sometimes difficult to make.

Although demography is traditionally concerned with human populations, in a wider sense it could also be viewed as the science dealing with inflow, outflow, aging and internal change of *any* population. Human demography has developed many concepts and tools for the description, analysis and modelling of these events, which can be applied to other populations as well. In this sense, demography of the firm is one particular application of demography, and as such the name should not give rise to any confusion. Nevertheless, confusion arises over what exactly is meant by demography of the firm. On the one hand, similar names are used for totally different activities, and on the other hand, similar demographically inspired activities in other disciplines are labelled differently. Some clarification is necessary here.

A first source of confusion is that similar names are used for different activities. The first and most important example of this kind is the name *business demographics*, which is used for a branch of applied demography concerned with marketing research. *Workforce demography* deals with the demography of the employee population *within* firms (Keyfitz, 1973): inflow, outflow, age structure and internal mobility of employees within a firm. Again, the resemblance with the demography of the firm is close enough to stir confusion. A closely related field, but with a confusing name, is called *organizational demography* (Pfeffer, 1983). Here, the internal structure and heterogeneity of the workforce of the firm is an important determinant of organizational outcomes.

A second confusing point is that demography of the firm is sometimes labelled differently. *Economic demography* is the term used by, for instance, Statistics Netherlands for statistics relating to founding, closure, firm size and firm activity structure. Although this term is certainly appealing, it also suggests a branch of human demography dealing with the interrelations between economy and population. Other terms that have appeared in the literature are *firmography* (Van Wissen, 1997) and especially *industrial demography*. In order to avoid confusion, the term demography of the firm will be used consistently throughout this article.

3. Antecedents of the demography of the firm

The study of demography of the firm is a multidisciplinary area of research. Firm founding and disbanding are studied in many disciplines, and thereby often implicitly or explicitly a demographic perspective is used. This amounts to a focus on the *population* level, and the impact of *entry* and *exit* on population *structure* and *change*.

Although the name might suggest otherwise, until now demographers have had little to do with the demography of the firm. At the same time, demographic *methods* are increasingly being applied in this field, primarily in the form of *life tables* of populations of firms and more generally in studying the relation-

ship between age and survival of firms (examples are Carroll, 1983; Freeman et al., 1983; or Brüderl and Schussler, 1990). Previous research in the field of the demography of the firm has mainly taken place within sociology and industrial organization, and to a lesser extent within economic geography. In economic geography (or closely related disciplines such as regional economics and regional sciences) demographically oriented research of firms is primarily focussed on regional determinants of firm entry and migration (Reynolds et al., 1994), regional employment change (Gudgin, 1978; Beesley and Hamilton, 1994), or regional innovativeness (Audretsch, 1991).

In 1965 the organizational sociologist Stinchcombe introduced the term demography of organizations, which, according to him, was mainly concerned with birth and death processes (Stinchcombe, 1965). The demographic study of organizations has taken root within a subfield of organizational sociology, called *organizational ecology* (Hannan and Freeman, 1977, 1989; Carroll and Hannan, 2000). Organizational ecology is not concerned with the micro level of the individual organization, but with the macro level of changes in size and composition of the population of organizations. In this dynamic perspective, selective processes of foundings and survival bring about change. New organizational forms are created, while older, less successful forms die. Incumbent organizations may also change in a process of *adaptation* to changing circumstances, but there are strong *inertia* effects within organizations that oppose adaptive change. Selection, adaptation and inertia are the essential concepts of the ecological method.

In economic science, demographically oriented research has followed a totally different stream. The fate of an individual firm has never received much attention in mainstream neo-classical economic theory. After all, this theory is concerned not how firms actually behave, but rather how firms would behave under profit maximizing assumptions. Demography traditionally has a strong empirical footing, and actual behaviour of firms is therefore much more interesting than deduced behaviour from normative assumptions. Fortunately, this view has gained popularity in economic sciences as well in the last decades, as witnessed in the growth of such subdisciplines as industrial organization and evolutionary economics (Nelson and Winter, 1982). Another empirically oriented strand of economic research is industrial organization. Here firm *entry* and *exit* within different market structures are being studied extensively. Recent overviews are given, for example, by Siegfried and Evans (1994) or Caves (1998). An important research theme here is the influence of *barriers* to entry or exit. These studies provide important economic mechanisms for demographic events, an element not very well developed in the sociological approach.

There are other fields of economic research that touch upon firm demography. A persistent subtheme in economic sciences is the study of entrepreneurship (Van Praag, 1999). Factors and motivations for entering or leaving entrepreneurship could be classified under firm demography, although from a labour market perspective. The relatively new field of *evolutionary economics*, initiated by Nelson

and Winter in 1982, is inspired by biological theories and models of selection and adaptation. It does not deal with demographic events *per se*. Rather, the link with firm demography is indirect, using biological metaphors in theories of firm behaviour. In evolutionary economics the focus is not on equilibrium but on change; not on optimal behaviour, but on path dependency; not on determinism but on chance and selection. Therefore, there are many similarities with the field of organizational ecology (see Winter, 1990, for an overview).

Since sociologists and economists produce their fair share of work in this broad multidisciplinary field, is there a special need for a demographic contribution? What can be gained from the demographic metaphor? The next sections try to give an answer this question. First, attention is focused on the question why, if at all, demography of the firm is a useful exercise with added value to the study of firms. Next, a more detailed analysis is presented of the main similarities and discrepancies of firm versus human demography.

4. The added value of demography of the firm

Demography may be defined as the study of changes in the size and composition of populations. Population size may change as a result of birth, death and migration processes. The composition of a population may change due to selectivity in birth and death processes, as well as change in the characteristics of incumbent members of a population. Selectivity in entry and exit from a population, in combination with internal change of surviving members, is a relevant field of study, not only for human populations, but also for firm populations. The methods and techniques of demographers are exactly geared to this goal. Firm death, or its complement, firm survival, is not a random process. Firms that exit have other characteristics than surviving firms. Clearly, surviving firms are in a better shape than non-surviving firms. The mortality rate of a firm population is a good indicator of its fitness. Closing firms are also different from entering firms, and much can be said about the selective nature of firm mortality. Economists have rigorous and elegant theories about these processes, and sociologists have developed their own ideas about them. If we accept that better performing firms have higher survival probabilities, then, irrespective of the exact nature of these processes, almost by definition firm survival can be viewed as *survival of the fittest*. The contribution of demographers is not in presenting yet another theory of why some firms survive and others die. Rather, demographers study the nature of these selectivity processes, and their consequences at the population level, in terms of the changes in size and composition. It is the link between the micro processes of selection and change, and their macro consequences at the population level that is the potential added value of demographers in this field. The exact nature of entry and exit processes is, of course, different from human populations, and it is a mistake to pursue the demographic metaphor too far in this direction. Nevertheless, evolutionary economists and organizational sociologists are inspired by apparent

parallels between economic change and biological processes of change, so there may be some fruitful fields of overlap also at the theoretical level. However, this is not the *raison-d'être* of firm demography. In a way, *any* rule of selection for entry or exit can be studied in a demographic framework, as well as *many* processes of internal changes in key characteristics of incumbent firms. The art of firm demography is in drawing conclusions out of these micro processes to the macro level of population composition and change. The line of work need not be from the micro to the macro level alone. The reverse process can be useful as well, i.e. from an observed time path of a population of firms, in terms of size and composition, to the micro level of firm processes. The following three research questions capture the essentials of this point of view of firm demography:

- Which firms have a higher survival probability, why are there differences in firm survival, and what are the population consequences?
- What are the characteristics of new firms *vis-à-vis* existing firms, why are they different, and what are the population consequences?
- What are the essential changes in incumbent firms in a population, what are the determining factors, and how does it affect the composition and survival of the population?

These questions each contain three elements. The first deals with the *systematic description* of vital events and population change. This is what demographers are particularly good at. Demographers are not satisfied with descriptions of net change. The time dimension can be decomposed into the dimensions of age, period and cohort. For instance, by disentangling net change in fertility into the dimensions of age, period and cohort, many new insights are gained. It then appears, for instance, that period fertility is quite different from cohort fertility, and that changes in fertility have a quantum (intensity) and tempo (timing) component. In firm demography, this type of systematic descriptive analysis is still in a very early stage. The second element is *explanatory analysis* of systematic differences in demographic events in the population. Here, economic and sociological theories are relevant, and we are therefore on shared territory with the other disciplines in this field. The third element deals with the *population consequences* of these differential processes of birth, death and internal change. Again, demographers have developed specific tools for this type of micro-macro aggregation. Here, we are not too far away from taking a step into the future. For instance, what would happen with the size and composition of the population if the observed systematic regularities in entry and exit would prevail in the future?

Despite the formal resemblance between dynamics in firm and human populations, there are many differences between both fields of study. In the next two sections we will discuss the most important similarities and differences.

5. Demographic components

When comparing the basic demographic components between firm and human demography, a number of questions need to be addressed. The first is what constitutes the basic (primary) events in firm demography. Undoubtedly, founding and dissolution are the key demographic events. These concepts are related but not equal to entry and exit as used in economic sciences. A firm may enter a market as a result of founding, but also by entering a new market through migration or product diversification of incumbent firms. Therefore, in principle, firm migration (including opening up new branches) and change of product may be studied by firm demographers as well.

Firm age is a measure of the progression of time between these two existential events, and age and aging are therefore extremely important in firm demography. However, there are important differences between biological and organizational aging processes, to which we will come back later. If we introduce the spatial dimension, the migration component is also of interest. However, as will be explained below, firm size is an extremely important indicator, and therefore *change in size* is a primary event in firm demography. In this respect, there is an analogy with the demography of fish populations, in which size and growth of the fish play an important role (see e.g. Gulland, 1975; Hallam et al., 2000). Finally, mergers, take-overs, acquisitions, and similar complex corporate events also belong to the field of firm demography. Admittedly, the demographic analysis of these events is still in its infancy, and standard demographic methods have not much to offer here, except perhaps some concepts and tools from household demography.

A second question is whether the definition of these events in human demography is suitable for firm demography. For firm closure and migration, this is indeed the case. Of course, other explanatory processes are important for firms, but the intensity of the process can be expressed as a simple *mortality* or *migration rate*. The underlying form is similar: within a given period, there is a population at risk of experiencing the event, and there is a count of the number of occurrences of the event. This is familiar territory for demographers, who have established ways of analysing these phenomena, both at the micro level of the firm and the macro level of the population. Unfortunately, this is not the case for the birth process. Establishing parent – offspring relationships is very difficult in firm demography. Nevertheless, a measure of the intensity is often calculated. There are basically two schools of thought here: one relates the number of entries to the population of labourers (Beesley and Hamilton, 1994); the other relates entries to the population of incumbent firms (this is the usual approach in the ecology of organizations). These two schools mark the distinction between an entrepreneurial versus an enterprise approach. The entrepreneurial approach might be tackled by the standard tools of multistate demography. For instance, a multidimensional model of the transitions between the states of unemployed, employee, self-employed and employer might prove very valuable here. A mixed approach is also possible, in

which the total number of births is the sum of two separate processes, and where the resulting new firms have different size distributions (Van Wissen, 2000a). Another related issue is whether the birth measure is really a *rate* (an occurrence/exposure ratio, as defined above), or rather a *count*. If we treat foundings as a count, the parental population remains unknown. This view of firm founding is highly similar to an immigration process. Indeed, in many economic models of firm evolution, entry is a random process (see for instance Jovanovic, 1982). A micro interpretation of the founding decision is then difficult to make. More theoretical and empirical work is necessary in order to resolve these issues. In any case, this research should be guided by sound demographic principles.

6. Population structure

6.1. AGE

Age is the master clock of all living things, and the most important demographic variable. Firms also pass through a life cycle, although this progression is not driven by biological decay. Therefore, the meaning of age is intrinsically different from that in human populations. Most empirical studies have focused on two possible effects of aging upon firm performance: the effect on the survival probability, and the effect on firm growth and size. There is a general agreement that younger firms have a higher mortality rate, which is called the liability of newness, and that the mortality rate declines with age (Freeman et al., 1983; Hannan, 1989; Carroll and Hannan, 2000). An important hypothesis behind this observed relationship is that firms learn from their behaviour over time. Mature firms are therefore better equipped than young firms, who still have to learn the tricks and avoid the pitfalls of market operation. This is called the theory of the *learning organization*. Another theory states that firms have intrinsic differences in capabilities and skills, which cannot be overcome. The weaker firms tend to die out earlier than the more skilled firms. Consequently, the average mortality rate of the selective population of surviving firms tends to decrease over time. This is called the *selectivity* hypothesis, and a particular example of the well-known mover-stayer mechanism.

Both hypotheses have found empirical support in the literature (Caves, 1998), but the situation is more complicated than this. The size of the firm increases with age as well, but the growth *rate* decreases. Figure 1 depicts the relationships between firm age, size, growth and mortality. Some of the arrows in this figure will be explained below. Decreasing growth rates with firm age have been explained with reference to obsolescence of technologies of older firms, but this is not in accordance with higher survival probabilities at higher ages. An extension of the selectivity hypothesis may help to solve this contradiction. Firms have intrinsically different risk preferences. High-risk firms have on average higher growth rates, but also higher mortality rates. As a cohort of firms ages, the risk-averse firms become more dominant in the surviving population. This has the effect of increasing the survival rate, and at the same time lowering the growth rate. This process may

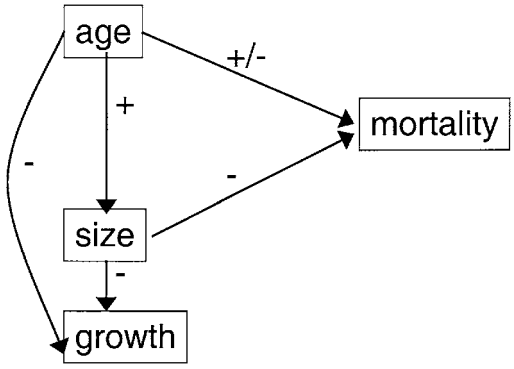

Figure 1. Relationships between firm age, size, growth and firm mortality.

be given an additional dimension by shifting the focus from the enterprise to the entrepreneur. For many small firms there is a close connection between the life cycle of the firm and that of the entrepreneur. Apart from intrinsic differences in risk taking between entrepreneurs, it may be hypothesised that there is a negative relation between risk taking and age of the entrepreneur. He or she may be willing to take chances early in the career, but less so after ten or twenty years. This type of research of careers of entrepreneurs can be cast in a demographic life-course perspective. Nevertheless, the effects of organizational age on demographic events remain to be fully understood. On the one hand, aging implies learning, and becoming better equipped. On the other hand, aging may mean increasing structural inertia, and becoming obsolete. Carroll and Hannan (2000) have tried to capture both types of processes in one general formulation, using the language of formal logic. However, much theoretical and empirical research is still needed. From these remarks, it can be concluded that age matters for firms, but the theoretical arguments are still not totally clear. Moreover, the effects of age are less pronounced than for human populations, and should be evaluated in interaction with firm size.

6.2. COHORT

It is significant that Stinchcombe, when he introduced the term demography of organizations in 1965, conjectured that firms are shaped to a large degree by the circumstances at the time of their founding. In other words, a strong cohort effect is present. This has proven to be one of the leading thoughts in organizational ecology. In the ecological, but also in the evolutionary economics literature, *inertia*, or resistance to change, is one of the main forces determining firm behaviour. Change in the economy is therefore to a large degree the result of selective processes of entry and exit. New firms enter with new technologies and organizational forms; the successful firms survive and grow, whereas obsolescent

technologies exit the market. This view of the economic sector is close to Ryder's observation of cohort succession as the essential force of social change (Ryder, 1965). Another instance of a cohort effect in organizational mortality is *density delay* (Carroll and Hannan, 1989). Density dependence (i.e. the effect of the size of the population on founding and mortality rates) in organizational mortality is one of the most studied phenomena in the ecology of organizations. Density dependence is a contemporaneous effect, which can be classified largely under period effects (see below). Density delay is the effect of density at the time of founding on vital rates later in the organization's life. This density delay would help to explain the negative slope of the density curve over time beyond the point where the population has reached its maximum size.

There are a number of possible explanations for density delay. First, firms founded in times when there are already many firms in the market and competition is intense, cannot afford the luxury of reorganizing and adaptation to overcome the initial founding period. Therefore, they are poorly designed for large-scale operation in later life and face higher than average mortality rates. Second, since there are so many other firms that occupy essentially the same *niche* in the market (*tight niche packing*), newly founded firms have to search for a spot in the periphery, where they have to exploit inferior resources. Consequently, the mortality rate of this subpopulation is higher than that of subpopulations in the centre of the niche. A third possible explanation comes to the opposite conclusion. Only very fit firms are able to start and survive the founding period in difficult circumstances of strong competition and tight niche packing. The less fit firms disappear very soon after founding, or survive not even the gestation period. Therefore, surviving cohorts that were founded in a period of maximum density are fitter than others, and have lower mortality rates. As it turns out in empirical research, density delay generally has a *positive* effect on mortality, which supports both the resource scarcity and niche packing hypotheses, but not the cohort fitness hypothesis. These combined effects of the birth period imprinting, density delay and inertia lead to the conclusion that there is a strong cohort dimension in organizational processes. One would expect, therefore, that inter-cohort differences are significant. Empirical verification of this hypothesis remains to be done, however.

6.3. CALENDAR TIME

There is no doubt that period effects, such as war or political events have a strong effect on firm behaviour. Moreover, it is customary to interpret the temporal variations in the business cycle as period effects as well. This cycle is an important indicator of firm start-ups and closures (Siegfried and Evans, 1994; Caves, 1998). In a growing market, it is easier to start a firm, acquire new customers, and survive, than in a shrinking market. But what exactly causes this development of the market? Economists stress demand side and business cycle considerations (Audretsch, 1994), but also industry life-cycle effects (Rajshree, 1997). The life

cycle of an industry starts with a new product. Initially, this new product is not known, and the number of firms producing this good is very small. In time, sales increase as customers familiarize themselves with the product. Founding rates go up, and the number of firms increases, until the market becomes saturated (the supply approaches the carrying capacity). As the population closes the gap with the level of the carrying capacity, competition increases, and founding rates drop, while mortality rates increase. In order to maintain a profitable market share, prices go down, and efforts are taken to decrease production costs. Process innovations are introduced, which require substantial investments, which can only be made profitable through economies of scale. This process drives out firms that are unable to survive this reorganisation, while it effectively prevents new firms from entering the market: they need large start-up investments, and must build up a large market share in order to become profitable.

In the ecology of organizations this phenomenon is called *density dependence*, the impact of the size of the population on vital rates: as population density rises, founding rates first increase, then stagnate and subsequently fall. Mortality rates first drop and then go up. Consequently, the population starts small, first grows slowly, then faster, until a peak in the population size is reached, after which it declines to a much smaller size (Figure 2). This empirical regularity has been observed in numerous studies in organizational ecology. Carroll and Hannan (2000, pp. 218–219) give an overview. The status of this empirical law is comparable to that of the demographic transition in human demography. Organizational ecologists follow the economic view that competition is a basic force, but *legitimization* is another important factor (Hannan and Carroll, 1992). An organizational form is legitimized in society if it conforms to a basic set of rules (formally), or if it is simply taken for granted (constitutive legitimization). The size of the population is an indication of the degree of legitimization of that organizational form in society. However, while legitimization and competition can explain an increase in the size of the population up to the level of the *carrying capacity*, they do not tell the full story of the decreasing slope after having reached this upper level. For instance, there is no reason to believe that legitimization, or taken-for-grantedness of the organizational form, would diminish strongly in time, nor that competition would increase even if the population no longer grows. In order to explain the negative slope of the curve beyond the level of the carrying capacity, cohort effects have to be introduced (as explained in sub-section 6.2 above), as well as additional population age-size interactions, which may be interpreted as industry life-cycle effects.

Density variations over time are the combined result of firm entry and exits. From the collected theoretical and empirical evidence, it appears that entry and exit should be negatively related over time. In the first phases of the life cycle, entry is high and exits are low, whereas in later phases the reverse is true. Nevertheless, most empirical studies find positive correlations over time (Siegfried and Evans, 1994; Caves, 1998). The most likely explanation for this observation is that a large

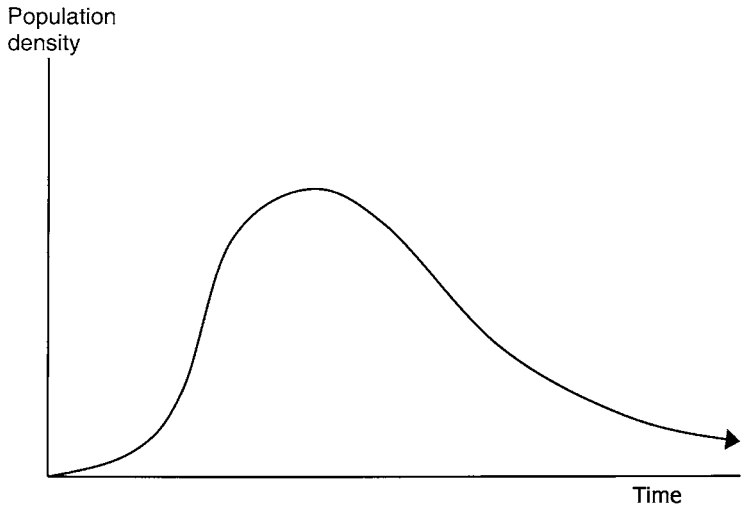

Figure 2. Dynamics of density of firm populations over time.

number of entries in one year causes a large number of exits shortly afterwards and in the next years, due to the liability of newness. This issue could be resolved by introducing age-standardized mortality rates.

Density dependence shows that the micro-level and macro-level processes interact. On the one hand, the collective behaviour of the population is the result of numerous micro decisions of founding and disbanding; on the other hand, these micro decisions are at least in part caused by the macro characteristics of the population. For economists this is hardly new, since it is the essential mechanism of the product market. However, it is not often used in human demography, except at the theoretical level. These interactions should be taken into account in modelling efforts of the trajectory of the population over time. Therefore, a standard cohort-component projection model cannot be applied to firms. An example of a projection model of firms that resembles a cohort-component model, but includes micro-macro relations, and which is specified at the interregional level, is given in Van Wissen (2000a, 2000b).

This discussion shows that one of the most commonly labelled time effects, viz. the economic business cycle, is not a 'pure' time effect, but to some extent confounded with cohort and age effects. The demographic tool of the age-period-cohort (APC) model, applied to firm founding and mortality, could shed light on the relative strength of each of these dimensions. Another conclusion is that, due to the presence of reciprocal micro-macro linkages, the business cycle cannot be taken as exogenous when modelling the time trajectory of firm populations.

6.4. SIZE

Age, cohort and time do not exhaust the basic dimensions of the demography of firms. Firm *size* is as important an indicator in the demography of the firm as age is for human demography. In industrial organization, the population pyramid reflects the size distribution, not the age distribution of the population of firms (Hayter, 1997, p. 192). Size is a major source of heterogeneity in firm performance. As discussed already, there are important age-size interactions. This interaction takes a number of forms. First, age and size are highly positively related: old firms tend to be larger than young. Therefore, many effects that can be attributed to age may also be attributable to size, and many size effects may in fact be age effects. Second, firm *growth* is negatively related to age: the older the firm, the lower the growth rate. Third, the interaction between age and size in determining firm mortality is quite complex. Carroll and Hannan (2000) report various studies that show contradictory results: in some, the effect of age is positive, while in others it is negative. In order to solve this puzzle, they analyse a longitudinal data set of automobile manufacturing populations in a number of countries, where the effects of age and size can be clearly separated. They find a strong age-size interaction pattern: although there are exceptions, in populations with mainly small organizations, the effect of age on mortality is positive, in populations with mainly large organizations the age effect is negative. This difference is shown to correspond to a theory that distinguishes between *positions* of the firm: firms in *fragile* positions have an immediate advantage over others, but this advantage is frail: when the environment changes over time, the advantage disappears. This corresponds to a positive age effect on mortality. *Robust* positions, on the other hand, provide advantages in the long run, even when the environment changes. Firms in robust positions show a negative age dependency. In general, large firms are more likely to hold robust positions, while small firms tend to occupy fragile positions. Another result of this position theory is that the *liability of smallness* assumption, which states that smaller firms have a larger mortality risk than others, and empirically confirmed in numerous studies (Caves, 1998; Carroll and Hannan, 2000), applies at *higher* ages.

While organizational ecologists and demographers primarily focus on age, in economic research most attention has been given to the effects of firm size on *growth*. Economists distinguish between *decreasing*, *constant* and *increasing returns to scale*. Gibrat (1931) proposed a simple mathematical model, in which the growth rate of the firm was unrelated to its size, which is consistent with constant returns to scale. His model was not based on economic principles, but appeared to be reasonably robust in practice, when applied to different industries in different time periods and countries (Hart and Prais, 1956). However, more recent research has shown that the growth rate decreases with increasing size, even after controlling for the effect of age (Evans, 1987a, 1987b, Dunne et al., 1988; Sutton, 1997). Sutton (1998) showed theoretically that an upper and lower bound of growth based on size could be specified.

6.5. LOCATION

The geographical or regional dimension is another source of heterogeneity within the population of firms. The regional dimension may be useful in its own right, simply because we are interested in events that happen within a given administrative boundary, or if we want to compare similar events across different locations. However, space and regions may have additional meaning. The interaction between the firm and its regional environment is a crucial determinant of firm behaviour. Firms operate in an environment of customers, suppliers and deliverers, local and regional competition, and more generally in a network of relationships with usually a strong spatial dimension. For economists, the notion of *economies of agglomeration* has become an important notion in recent years (Krugman, 1995). Economies of agglomeration may be viewed as a specific form of localized increasing returns (Boschma and Lambooy, 1999). Traditional neo-classical economic explanations for these regional growth disparities, such as natural resources and amenities, accessibility, factor and transportation costs, or labour market advantages, are jointly part of the story. More recently, new explanations for this phenomenon have focused on the concepts of history dependence, chance, and the 'learning region', which are familiar terms in the field of evolutionary economics as well (Boschma and Lambooy, 1999). In economic geography, the notion of endogenous regional growth has received much attention in recent years. Endogenous growth is viewed as the result of local knowledge and knowledge spillovers, both within and between industries.

Organizational ecologists have also begun to explore the notion of space and region in their models of density dependence. They have found, for instance, that the two primary processes of density dependence, competition and legitimization may operate at different geographical scales. For instance, competition is often relevant at the regional level, whereas legitimization operates on a much wider national or even international scale (Hannan et al., 1995; Bigelow et al., 1997). The theory of endogenous regional growth and knowledge spillovers should have major implications for the theory of density dependence. In this view, density dependence should be interpreted as *local* density dependence.

For the demography of the firm, these regional disparities are important, since they imply endogenous regional variations in entry, exit, and growth. Moreover, when speaking in terms of entry and exit, a market is implied at a certain geographical scale, either at the (inter)national, regional, or local level. Firm entry in a regional market may be the result of firm founding, or starting-up a new branch in the region, or firm relocation. Firm migration is traditionally the field of economic geographers (Pellenbarg, 1985).

Other firm characteristics may be important sources of heterogeneity as well. Of these, organizational activity, or type of industry, is undoubtedly the most important. In general, firm demographic research is conducted for single populations of organizations or industries. In addition, other characteristics may play an

important role, such as legal form, main versus subsidiary unit, etc. Nevertheless, all too often, serious data limitations restrict the analysis to what is available.

7. Conclusions

Demography of the firm is not a new activity, but an established subfield of research within a number of disciplines, most notably sociology, economics, and geography. Therefore, it lacks one coherent paradigm. The result is that more or less the same concepts and theories, but with different names, exist side by side. For instance, the theory of density dependence in organizational ecology has many similarities with the product life-cycle theory in economics.

Summing up, this paper argues that the demography of the firm offers added value to the study of firm dynamics. The demographic metaphor does not arise because of applying biological laws to firms, but because of the methodological similarities in population dynamics and micro-macro linkages. However, there are also important differences. First, the effects of age are less pronounced for firms than for humans, and the underlying mechanisms, which are not biological in nature, are less clearly understood. Second, cohort effects seem more pronounced for firms than for humans, because of imprinting and structural inertia. Third, period effects are important as well, but there are strong reciprocal relationships between the macro level of the business cycle and the micro level of firm performance. Fourth, there are also strong reciprocal relationships between the regional economy and the firm, and one should expect significant regional variation in basic demographic events such as founding, growth and disbanding, which in turn is an important determinant for future firm behaviour in the region. Finally, but certainly not the least important distinction between human and firm demography, firm size is the key characteristic of the firm and a major determinant of all demographic events. Research in any of the other dimensions of firm demography without taking into account size differentials, is likely to be biased.

The metaphor of the demography of the firm brings new insights into the area of firm population dynamics. By concentrating on the events of founding, disbanding, migration and growth, it combines elements of a larger interdisciplinary field where economists, sociologists and geographers are active. The emphasis on the demographic dimensions of time: age, cohort, period, as well as on size, provides a logical consistency to the analysis of the dynamics of firms, and a potential framework for integration of different views. Here again, the parallel with human demography is striking. Nevertheless, the metaphor should not be carried too far or pursued for its own sake. According to Aristotle, a metaphor is giving a thing a name that belongs to something else (Barnes, 1996, p. 149). Metaphors are useful as a new way of looking at familiar things, but this view is almost by definition an incorrect one when taken literally. Firms are institutions, not biological entities. The ultimate goal of the demography of the firm is a better understanding of the

mechanisms of change in firm populations, and not a quest for biological parallels. The demographic framework may prove very useful in that task.

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