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KRISTINA NYSTRÖM

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Some might say a journey has now ended. It is true that I have now finished writing a thesis and that I have spent several years of taking PhD courses, writing on my thesis and teaching here at Jönköping International Business School (JIBS). It is also true that I have truly enjoyed this journey. I feel that now I have arrived at one station and not come to the end of the journey. The reason why the journey has still not ended is that I have always had, and still have, a desire to learn new things. It is this desire that took me from the woods of my childhood in Kolmården to Linköping University and finally here to Jönköping. During the journey I have experienced that the fascinating thing with knowledge is that the more you learn the more you realise that there are so many things that you would like to know more about. When I started to study economics at Linköping University, I thought economics was all about money. However, the one essential thing I learned rather quickly about economics is that it is not all about money. Economics is about people, their actions and interaction in the society. This is what makes economics so fascinating and usable, and this is what inspired me to continue to study economics.

This journey has not been a lonely journey. Several people have contributed in different ways. I would especially want to thank my supervisor Professor Börje Johansson and my deputy supervisor Professor Charlie Karlsson (who is also the co-author of chapter 5) for advice and support and their never-ending patience with reading my essays. I would also like to thank Professor Bo Södersten and Professor Åke E. Andersson who have chaired the Friday seminars here at the Economics department, where the different essays included in the thesis were presented and discussed. At the very beginning of my studies I thought the Friday seminars were tough and horrible events. However, during the years these seminars have turned out to be the highlight of each week. During these seminars, I have received many valuable comments from the participants, which are highly appreciated and have improved my work considerably. I would also like to take the opportunity to show my appreciation to my colleagues at the Economics department here at JIBS. It is all of you together who create a stimulating environment for research, and it is, among other things, your good sense of humour that has made this journey so enjoyable.

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Finally, I would like to thank my family who bring me the greatest joy and happiness in life. The greatest appreciation of course goes to my beloved
husband Per, who is always there for me to encourage and support me. He is the one that makes sure that I never lose direction. During the journey of writing this thesis, two wonderful daughters have joined us. Even though Maja and Märta are the most precious thing that has happened during my PhD studies, I have never regretted the decision to be become a PhD student. I think (and hope) that they have not suffered too much on the way, so that they can continue the journey towards new knowledge and experiences together with me.

Jönköping, December 13, 2005
Kristina Nyström
Abstract

This thesis consists of five individual essays and an introductory chapter. The essays are all in the field of industrial dynamics and more specifically focus on firm entry and exit in Swedish industrial sectors. The essays mainly contribute to the empirical literature on entry and exit. In four of the five essays, panel data methods are used in the empirical investigation. The first essay presents the patterns of entry and exit in industrial sectors in Sweden and studies the importance of different determinants of entry and exit rates in industries. The second essay focuses on the relationship between entry and exit. The third essay has a regional perspective, focusing on regional determinants of entry and exit. It also investigates the importance of the differences in industry structure for differences in entry and exit rates across regions. The fourth chapter uses the theory of product life cycle to investigate how knowledge intensity differs in entering and exiting firms in different stages of the product life cycle. The fifth and last essay focuses on the importance of firm demography, in terms of firm size and age, for the decision to perform process R&D, product R&D or combine process with product R&D.
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Chapter 1.
Introduction and Summary of the Thesis

Kristina Nyström

1 Introduction

This thesis deals with the dynamics of entry and exit of firms in different industries in the Swedish economy. The thesis consists of one introductory chapter and five essays, which all separately contribute to the empirical literature on entry and exit.

The interest in entrepreneurship and processes of new firm formation has a long tradition in economic theory. The reason for this interest is obviously the importance of entrepreneurship and new firm formation in the structural adjustment of the economy. Entry is also strongly associated with the innovation process, since entry is one way to introduce a new production technology and/or a new product. Therefore, the entry and exit processes are basic driving forces underlying economic growth. These issues are indeed fundamental for economic growth policy.

It is interesting to note that theories and research about entrepreneurship and new firm formation get considerably more attention than exit processes. This is unfortunate, since exit is also a necessary and important part of the structural change process. From a purely technological perspective, a firm’s decision to exit might be the consequence of the decision to abandon an obsolete production technology. For a firm that produces goods or services that are no longer demanded by customers, exit is the ultimate consequence. For individuals involved in the process of closing down a firm, such as owners and employees, exit leaves nothing but disappointment, at any rate in the short run. On the other hand, from a more aggregate perspective, exit makes it possible to reallocate resources to new and more effective production, giving opportunities for new entering firms or for incumbent firms to expand their production. In this sense, to some extent, exit can also be seen as a sign of a healthy economy where innovation and structural change move the economy forward.

As mentioned above many researchers have been interested in the process of entry and exit, which has resulted in quite an extensive number of books and essays in this area. One may then ask, why add anything to this vast literature? The answer to this question is that in spite of the existence of all previous contributions many questions regarding the processes of entry and exit remain
unanswered. The empirical literature also shows that patterns of entry and exit differ significantly over space and time as well as between industries. This thesis adds to the existing empirical literature because it uses a unique dataset covering all firms in the corporate sector in both the manufacturing and service industries. In addition, the thesis contributes to the existing literature by using panel data methods which combine cross-section and time-series data and which have been developed considerably during recent years.

The purpose of the thesis is to empirically analyse the patterns of entry and exit in different industries in the Swedish economy. Special attention is paid to some selected dynamic aspects of entry and exit, including patterns of entry and exit in industries, the interrelationship between entry and exit, regional patterns of entry and exit, entry and exit as an integral phenomenon in a product life cycle model and finally process and product R&D from a firm demography perspective.

This introductory chapter is organised as follows: Section 2 gives a brief overview of the relationship between entrepreneurship and economic growth. Section 3 presents some definitions and economic theories related to entrepreneurship, economic dynamics and processes of entry and exit. Since this thesis is primarily an empirical contribution, section 4 presents some general and very influential empirical contributions from an international and a Swedish perspective. Section 5 presents the two datasets used in this thesis and discusses issues related to defining and measuring entry and exit. Finally, in section 6, the five essays included in the thesis are summarised and the main findings of each essay are highlighted.

2 Entrepreneurship and growth

The relationship between entrepreneurship and economic growth is an interesting issue both from a theoretical and an empirical perspective. The definition of economic growth is not unambiguous, but let us for simplicity say that economic growth is manifested in productivity growth, growth of GDP and employment growth. Wennekes and Thurik (1999) note that the importance of the entrepreneur for economic growth differs substantially between different fields in the economic literature. The role of the entrepreneur ranges from just being implicitly present in neoclassical and most endogenous growth theories, to playing a key role in industrial economics and evolutionary economics. The role and definition of entrepreneurship in economic theory will be more explicitly discussed in the next section, but before this discussion starts it is appropriate to highlight some empirical evidence that emphasises the role of entrepreneurship, competition and structural change for economic growth.

Karlsson et al. (2005) summarise the empirical evidence on the relationship between entrepreneurship and growth and conclude that competition increases employment and enhances total factor productivity growth. The effect of small
firm formation on net employment growth and economic growth is more unclear.

Disney et al. (2003) investigate the role of technological and organisational change within existing firms versus market selection mechanisms, such as entry and exit, for productivity growth. They find that the market selection mechanism contributed to 80-90 per cent of the total factor productivity growth in UK manufacturing firms during the period 1980-92.

Fritsch and Mueller (2004) emphasise the role of new firm formation for regional development. They find that it is not just the direct effect in terms of new jobs associated with entry that matters. Entry of new firms has also indirect effects since it increases competition and improves the conditions for suppliers. These indirect effects of new firm formation are in fact larger than the direct effects. According to the study by Fritsch and Mueller, it takes eight years before the maximum effect of firm entry on regional development is reached.

Also Reynolds et al. (2004) show that it takes time before the effect of entrepreneurship and new firm formation influences economic growth. This means that politicians trying to stimulate entrepreneurship and economic growth have to be patient and await the long–term effects. Dutz and Hayri (2000) show that a higher level of economic change, measured as the average age of the oldest firms, has a positive effect on economic growth. For Sweden in the period 1976-95, Fölster (2000) finds that increases in self-employment boost overall employment in the economy.

3 Economic theory on entrepreneurship and economic dynamics

3.1 Entrepreneurship

Glancey and McQuaid (2000) summarise the role of the entrepreneur from different perspectives and distinguish between the role of the entrepreneur as a risk taker, resource allocator and innovator. These three perspectives all focus on the economic function of the entrepreneur. In addition to these perspectives, an entrepreneur can be regarded as a person with certain behavioural and individual characteristics that make him/her a novelty provider. An additional definition regards entrepreneurship as something that creates a new organisation (Glancey and McQuaid, 2000).

Cantillon (1755) was one of the pioneers in the field of entrepreneurship theory, using the word entrepreneur in an economic setting. He emphasised the important role of the entrepreneur as a risk taker. The entrepreneur was not necessarily the one manufacturing the good or service, it was someone who bought a good at a certain price and then sold it on the market for a price that was more unpredictable. Also according to Knight (1921) the entrepreneur has an important role in the economy as an individual with skills associated to
identifying and calculating risk and uncertainty. Knight specifically distinguishes between risk and uncertainty and argues that risk is predictable in the sense that the probability of a certain outcome can be calculated, whereas uncertainty cannot be predicted. Hence, it is the uncertainty that creates profits, and those individuals who are better suited to handle uncertainty will be profitable entrepreneurs.

Say (1803) and Casson (1990) emphasise the role of the entrepreneur as a coordinator of resources. The entrepreneur is the one who makes sure that the resources in terms of, for example, labour, capital and skills are allocated in the most productive and efficient way. Note that this does not necessarily exclude the entrepreneur from being a person taking risks and actually performing entrepreneurial activity.

The role of the entrepreneur as innovator was specifically spelled out by Schumpeter (1942). According to Schumpeter innovations occur when an entrepreneur carries out “new combinations”. New combinations according to Schumpeter’s definition means that a new good or a new quality of a good is produced. It may also be the introduction of a new method of production, finding new sources of supply of input factors, finding a new market or improving the organisation in an individual firm.

Karlsson et al. (2005) note that there is an obvious discrepancy between the theoretical definition of entrepreneurship and the operational definition of entrepreneurship. Nevertheless, entrepreneurship in empirical work is usually measured by the number of business start-ups or in terms of small-firm innovation.

As economists we are mainly interested in the economic function of entrepreneurship, and that is the focus of this thesis. Therefore, the theories on entrepreneurship, entry and exit presented in this section will have a strong focus on industry and firm characteristics and not on characteristics associated with the individual person who decides to start or close down the firm. This focus on industry and firm characteristics is further motivated by the findings by Storey and Wynarczyk (1996), who explore the importance for firm survival of industry characteristics, firm characteristics and the individual characteristics associated with the entrepreneur. They find that firm and industry characteristics such as industrial sector, firm age, firm size and location are more important than the individual talents associated with the entrepreneur.

3.2 Economic dynamics

If we now turn to economic theories that more specifically deal with economic dynamics, industrial change and entry and exit, many economists have been interested in this issue since the early 1900s. Marshall was an advocate of dynamic perspectives including the entry and exit of firms. An example is when he discusses “the constant rise and fall of large businesses” (Marshall, 1920). However, the perhaps most influential economist in this field is Schumpeter.
1. Introduction and Summary of the Thesis

According to Schumpeter (1942), economic development is something that comes from within the economic system, and the processes are to some extent “organic”. In such processes, innovations play an important role. When a new firm enters due to novelty by combination, this also facilitates the entry of other firms. Innovations are not evenly distributed over time; therefore they tend to appear in clusters that create waves of entering and exiting firms. Schumpeter called this process “creative destruction”. (Schumpeter, 1939) The process of creative destruction was later complemented by the concept of creative accumulation. In this description of how innovations are created, large established firms play an important role since they accumulate knowledge (e.g. R&D, product and process knowledge) and financial resources. This creates barriers to entry for new small firms (Schumpeter, 1942). These two views of the dynamics of the economy strongly suggest that differences between industries/technologies are an important factor to take into account.

The interest in evolutionary aspects of industrial dynamics was renewed during the last decades. Several authors have been inspired by Schumpeter’s analysis of economic dynamics and combined them with features from Darwinism. These models include components such as learning and introduce selection mechanisms such as the survival of the fittest among firms. An influential and pioneering work in this field is the book by Nelson and Winter (1982). Another interesting contribution in this field was made by the Swedish economist Gunnar Eliasson. His work is on competence blocs and the experimentally organised economy (see, for example, Eliasson, 1994). Another influential Swedish economist in this tradition is Erik Dahmén, who introduced the concept of development blocs (e.g. Dahmén, 1950).

Related to this tradition is the theory of noisy selection presented by Jovanovic (1982), which implies that a firm does not know its efficiency until it has entered the market. The firm decides to remain in the market if the actual efficiency is larger than what was expected prior to entry. Ericson and Pakes (1995) present a model of active learning. In this model a potential entrant knows the present value of all future revenues, but this value varies because of a random element in how the firm succeeds with its investments. The potential firm has to enter and invest in order to know the value of the opportunity available. In the passive learning model presented a few years later by Ericson and Pakes (1998), the firm does not even know the present value of all future revenues. The firm is only able to learn from what it knows about previous profits.

The theory that was later to be called the product life cycle theory was also inspired by the writings of Schumpeter (1942) and, among others, Kuznets (1929). The most important contributions in this field were made during the 1960s by economists such as Vernon (1966) and Hirsch (1967). The product life cycle theory describes the development of a product from innovation and introduction to the death of the product. During the life of a product, demand for different types of inputs, such as knowledge and labour skills, changes
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(Johansson and Karlsson, 1987). Firms that recently introduced a new technology or product, for example, are expected to need more qualified staff than firms producing standardised products. This implies that firms that enter and exit the market in different phases of the product life cycle reveal different characteristics concerning the knowledge intensity and skills of their employees. The patterns of entry and exit of firms can also be expected to change over the product life cycle. Important contributions in complementing the product life cycle theory with patterns of entry and exit have been made by Gort and Klepper (1982), Agarwal and Gort (1996) and Klepper (1996).

Another tradition in economics dealing with industrial change and renewal is the technological vintage perspective. This tradition began to develop as early as the 19th century, but grew significantly during the mid-20th century with authors such as Salter (1960) and Phelps (1962). Scandinavian economists are well represented in this tradition including the writings of Heckscher (1918), Svennilson (1944) and Johansen (1959). The vintage theory emphasises that once a production facility is established the possibilities to change production are limited. The firm uses a certain technology and has a set of routines that are difficult to change. Hence, an industry at a given point in time will consist of different groups of firms using different technologies. When new technologies are introduced by new or incumbent firms, older technologies will become obsolete and firms using such technologies will be forced to exit. This tradition emphasises that entry and exit are always interrelated and in a sense exit is a prerequisite for entry.

In Austrian economics, which has its origins in the writings of von Mises (1949) and Hayek (1937), the entrepreneur is regarded as a bold person who competes with other entrepreneurs. The profit opportunities created by earlier entrepreneurial errors stimulate further entrepreneurial discoveries. In Austrian economics, it is the opportunities for entrepreneurial profit that drive the market in the direction of equilibrium. However, since preferences and technologies always change, the market never reaches equilibrium (Kirzner, 1997).

The field known as industrial organisation began to take form during the period 1925-1940 (Masson and Qualls, 1976). The structure-conduct-performance approach became a common framework for analysing industry patterns. The basic idea in this type of analysis is that technical factors determine the structure of an industry, and that the structure of the industry influences firm behaviour and performance. Important technological factors are, for example, economies of scale and entry barriers (Masson and Qualls, 1976). The concept of entry barriers is of special interest in this dissertation since entry barriers influence the patterns of entry and exit in different sectors. Bain (1956) and Yip (1982) are authors who have contributed to the theoretical development in this field.

The entry barrier literature usually distinguishes between structural and behavioural barriers to entry. Structural barriers are defined as persistent
1. Introduction and Summary of the Thesis

structural characteristics of an industry, such as the existence of economies of scale, patents and strong R&D dependence, whereas behavioural barriers refer to reactions from incumbent firms to the threat of new entrants, such as incumbents firms threatening to lower their prices (Siegfried and Evans, 1994). This type of firm behaviour is usually assumed to be more common in concentrated industries. Barriers to entry can also work as barriers to exit. For example, structural entry barriers affect both the number of entrants and the entrants’ probability of surviving, which implies that they influence both entry and exit rates (Caves, 1998). Another interesting theory in the field of industrial organisation is the theory about contestable markets presented by Baumol et al. (1982). In this model it is the amount of potential entry, not the actual entry, that determines the market structure. This implies that if there is a threat from potential entrants to enter a concentrated market, the market can still be regarded as competitive.

Due to lack of empirical observations, especially time series on exit and entry, case studies of various industries were dominant until the early 1980s, when firm level data began to become available for many countries (van Dijk, 2000). The renewed interest in dynamic aspects combined with theories from industrial organisation literature, led the research approach in new directions. At the same time the availability of detailed firm- and plant-level data increased, which stimulated a series of new empirical findings. Some of these results will be summarised in the next section.

4 Previous empirical contributions on entry and exit

The major objective of this thesis is to study the empirical regularities of entry and exit in different industries in the Swedish economy. Therefore, as an introduction to this empirical study, it is appropriate to give a short overview of previous international and Swedish studies in this field. Here we shall concentrate on general aspects of empirical studies. References related to more specific topics will be discussed in the subsequent chapters.

4.1 International studies

Earlier studies and international comparisons suggest that over time annual entry and exit rates usually vary between 5 and 10 per cent (e.g. Baldwin, 1995 and Geroski, 1991). The cumulative effect of entry can be expected to be even larger. Baldwin (1995) estimates the cumulative effect of entry in the Canadian manufacturing industry over a ten-year period to be about 35 per cent of the total number of firms. International studies on entry and exit patterns across
industries in the manufacturing industry have identified substantial differences regarding entry and exit patterns (e.g. Dunne et al., 1988).

Caves (1998) provides an extensive overview of the theoretical and empirical work on the turnover and mobility of firms. Siegfried and Evans (1994) summarise empirical evidence on exit and entry based on 70 studies from 11 countries. These overviews show, for example, that the evidence regarding barriers to entry and exit does not always support the theoretical expectations suggested by the “entry barrier literature”. A summary of the empirical work on entry was also presented by Geroski (1995). Important empirical contributions in this field have also been made by, among others, Geroski (1991), Geroski and Schwalbach (eds.) (1991) and Baldwin (1995).

Other interesting empirical contributions are, for example, those by Acs and Audretsch (1989), who focus on small firms, Love (1996a and 1996b), who applies a spatial perspective, and Maskell (1992), who provides an analysis of entry and exit in Denmark. The empirical studies mentioned above have, among other things, found that recent entrants account for quite a substantial part of the existing stock of firms and plants. However, the new firms are generally quite small and therefore entry represents a small proportion of the output. Recent entrants also have a higher probability of exiting the market.

4.2 Swedish studies

Early Swedish contributions in this field are the previously mentioned studies by Heckscher (1918) and Svennisson, (1944). Several studies commissioned by the Swedish government contribute to the empirical knowledge of structural change processes in Sweden during the 1970s and 1980s, e.g. SIND (1980) and Aronsson (1991). Another empirical contribution on the dynamics of the industries in the Swedish economy is the study by Davidsson et al. (1994a, presented for an international audience in 1994b). The period covered in this study is 1986-89. The study is not very detailed on differences between industries since only 12 very broad industries are included in the study. The study concluded, for example, that of the total employment growth in small businesses 1/3 was due to new firms entering the market. The study was followed up by a similar study covering the early 1990s (Davidsson et al., 1996). These two studies also show the importance of regional factors affecting firms’ decisions to exit or enter. These regional aspects were developed further by Berglund (1999), using the same type of data as Davidsson et al. (1996).

5 Defining and measuring entry and exit

There are two types of measures used in the empirical studies on entry and exit: gross and net measures. Net entry means the pure change in the number of firms between time $t$ and time $t+1$ i.e. exits are counted as negative entry. Gross
entry and gross exit count entrants and exits separately, i.e. a gross entry measure captures if a firm displaces another firm. Early empirical work commonly used net entry measures (usually due to data availability), but more recent research generally uses gross entry and exit measures. It is preferable to use gross entry and exit measures if the researcher is interested in industrial dynamics and change, since gross entry and exit may be high even if net entry is low. In this thesis, the primary interest is in gross entry and exit measures.

In many cases it is interesting to put the absolute number of entries and exits in relation to a stock measure, i.e. to calculate entry and exit rates. Entry and exit rates are usually measured using the labour market approach or the ecological approach. Using the labour market approach implies that the number of entering and exiting firms is related to the employment in the industry. If the labour market definition is used, this approach implies that each individual in the economy is regarded as a potential entrant. In the ecological approach the number of entering and exiting firms is related to the number of incumbent firms (Armington and Acs, 2002). In this thesis the ecological approach is used, since the main focus of this thesis is on industrial dynamics and change.

There are also two alternatives regarding the entity of the empirical analysis, which can be either plants or firms. The definition of a firm refers to a legal entity, whereas a plant is defined as a geographical entity or production location within a firm. In this thesis, two different types of datasets are used, one that contains firm-level data and one that contains plant-level data.

Both firm-level and plant-level data are collected by Statistics Sweden. Details about the firm-level database regarding, for example, collection methods and the treatment of missing observations are described in Statistics Sweden (1998). The plant-level database is described in Statistics Sweden (1993). In the databases, the firms or plants are classified into different industries according to the Standard Industrial Classification system (SIC) at the 5-digit level. At the 4-digit level, this classification system corresponds to the European standard NACE Rev. 1. In both datasets, each firm or plant is assigned a unique identification code, which makes it possible to follow the activity of each plant or firm from year to year.

The firm database covers all industrial sectors in the non-financial sector and contains all firms in the corporate sector (SIC codes 1-93 except 65-67, 70 and 91). The corporate sector includes joint-stock companies, cooperatives, partnerships, limited partnerships, associations and some foundations. Sole proprietorships are not included in this definition since these firms are not defined as legal entities. For this data set, data for the period 1996-2001 are available, and for each year information from the balance sheet and profit and loss account for between 200,000 and 300,000 firms are available.

The plant-level dataset covers only the manufacturing industry (SIC codes 10-37) and all firms with more than 10 employees; a sample of plants with

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1 These industries are not included in the survey conducted by Statistics Sweden, since they are not defined to be in the corporate sector (SIC code 90) or belong to the financial sector.
between 5 and 10 employees are included in the dataset. This dataset includes information about the number of employees, the value of the production, value added, wages, etc. Data for 1990-1996 are available, and for each year the dataset includes between 8,000 and 9,000 plants. The content in the firm-level database and the plant-level database is summarised in Table 1. Chapters 2, 4 and 6 in this thesis will use firm-level data, Chapter 5 plant-level data and Chapter 3 a combination of firm- and plant-level data.

### Table 1: Coverage and content of the firm-level and plant-level databases

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<tr>
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<th>Firm-level database</th>
<th>Plant-level database</th>
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<td><strong>Industrial sectors</strong></td>
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<td>SIC codes 65-67, 70 and 91)</td>
<td>(SIC codes 10-37)</td>
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<tr>
<td><strong>Coverage</strong></td>
<td>All firms in the corporate sectors</td>
<td>All plants with more than 10 employees and a sample of plants with 5 to 10 employees</td>
</tr>
<tr>
<td><strong>Number of observations per year</strong></td>
<td>200,000-300,000 firms</td>
<td>8,000-9,000 plants</td>
</tr>
<tr>
<td><strong>Type of data</strong></td>
<td>Data from the profit and loss account and balance sheet</td>
<td>Wages, employment, value of production, etc.</td>
</tr>
<tr>
<td><strong>Period</strong></td>
<td>1996-2001</td>
<td>1990-1996</td>
</tr>
<tr>
<td><strong>Used in chapters</strong></td>
<td>2, 3, 4 and 6</td>
<td>3 and 5</td>
</tr>
</tbody>
</table>

### 5.1 Entry

The theoretical literature usually distinguishes between three types of entry. There might be totally new firms, already existing firms expanding the market or firms that are already active in another industry but decide to change industries. A totally new firm might be formed when an entrepreneur wants to introduce a new product and/or a new production technique. This type of entry is sometimes referred to as “greenfield entry” or “de novo entry”. If the new firm is started by people who were previously employees in the same industry, the firm is defined as a “spin-off”. There can be a great many reasons for an already existing firm to start a new firm. A firm might want to increase its production capacity, expand the geographical market or diversify its activities. The two datasets do not allow us to distinguish between firms that are

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2 Financial intermediation (SIC codes 65-67), Real estate activities (SIC code 70) and Activities of membership organisations (SIC code 91).
greenfield entrants, spin-offs, firms expanding their market or diversifying firms.

The same type of distinction between the three types of entry can also be applied when talking about plants rather than firms. As mentioned earlier, defining entry using the statistical material available for this thesis implies that entry is characterised as the appearance of a new identification code in the dataset. Note that in the case of reconstruction of a firm, i.e. if the firm or plant exits but is bought by someone else and restarted as a new legal entity with mainly the same employees, an exit and later an entry will be reported. Table 2 clearly describes different events and if and how they influence the definition of entry in the two datasets.

5.2 Exit

The general definition of an exit of a firm or plant is when the firm or plant ceases to exist (closedown exit). In the dataset used in this thesis a firm or plant exits when the unique identification code ceases to exist in the dataset.

Another type of exit is when the firm or plant changes its production activity. Note that the industry classification according to the SIC system implies that the SIC code is determined with respect to the dominating production activity in the firm or plant. This implies that this type of exit and entry may occur due to changes in production activity. In general, it is not possible to account for such changes in production activity in the empirical analysis. However, in some cases such changes may affect the definition of exit and entry. If a plant or firm changes production activities to an activity not covered by the collection method, this is reported as an exit. This phenomenon will mainly occur in the plant-level database, for example if a manufacturing plant becomes a plant involved in producing mainly another type of product classified as belonging to another industry outside the manufacturing sector.

The datasets used in the thesis does not allow us to identify mergers and acquisitions. When two firms merge or a firm acquires another firm, one of them is reported as an exit. When dealing with plant-level data, mergers do not cause any major difficulties since a plant is connected to a geographic identification and this definition is not affected by such ownership changes. The definitions of exit in the two different datasets are also clearly described in Table 2.

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3 Such a definition of entry and exit has a labour market approach where its employees and human resources and not its legal entity define the firm. For Swedish data the Swedish Agency for Innovation Systems (VINNOVA is developing methods and data in order to use this approach to firm demography. (see, Svanfeldt and Ullström 2001)

4 In the empirical analysis the firm or plant is assumed to belong to the same industry during all periods.
Table 2: Definitions of entry and exit in the firm- and plant-level dataset

<table>
<thead>
<tr>
<th>Activity</th>
<th>Firm-level data (All industrial sectors)</th>
<th>Plant-level data (Manufacturing industry)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Entry</td>
<td>Exit</td>
</tr>
<tr>
<td>Mergers</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Acquisitions</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Other ownership changes</td>
<td>No</td>
<td>No</td>
</tr>
<tr>
<td>Change of production</td>
<td>No^7/Yes^8</td>
<td>No^7/Yes^8</td>
</tr>
<tr>
<td>Change of name</td>
<td>No</td>
<td>Yes</td>
</tr>
<tr>
<td>Reconstruction</td>
<td>Yes</td>
<td>Yes</td>
</tr>
</tbody>
</table>

6 Outline of the study and summary of main findings

The thesis consists of six chapters, including this introductory chapter. Chapter 2 has the title “Patterns of Entry and Exit in Industrial Sectors in Sweden”. This essay gives a general picture of entry and exit patterns in Swedish industries. It uses data from all industrial sectors for the period 1997-2001. The essay also examines the influence of different incentives and barriers on entry and exit patterns. Variables that represent incentives and barriers comprise profitability, market growth rate, tangible capital intensity, intangible capital intensity, such as investments in R&D and patents, economies of scale and industry concentration. Even though the major contribution of this paper is empirical, the essay also makes a methodological comparison between using a one-way fixed effect panel data method and ordinary least squares (OLS). In the fixed effect model, unobserved industry-specific effects are included and the inclusion of the industry-specific effects removes the importance of those incentives and barriers that were prevalent in the OLS estimation. This means

^5 Other ownership changes except mergers and acquisitions which do not cause changes in the unique identification number.

^6 A change in production causing a change in the SIC code.

^7 If the firm remains in the corporate non-financial sector.

^8 If the firm enter or exit the corporate non-financial sector.

^9 If the plant remains in the manufacturing sector.

^10 If the plant enter or exit the manufacturing sector.
that the factors influencing entry and exit rates in different industries are largely industry specific, i.e. analyses of the determinants of industry entry and exit rates have to be carried out on a disaggregated industry level.

Chapter 3 - "Interdependencies in the Dynamics of Firm Entry and Exit" focuses on the relationship between entry and exit. This chapter investigates how previous entry and exit rates are interrelated with present entry and exit rates. Does previous entry stimulate more entrants through a multiplier effect, or does entry force others to exit through a competition effect? In a similar way it is discussed if previous exit forces other firms to exit because of the multiplier effect, or if exit leaves room for new entering firms through the competition effect. The contribution of the essay is both empirical and methodological. In the essay, four different estimation methods are compared. Two of them are specifically developed to satisfy the requirements of a dynamic panel data model. The method developed by Arellano and Bond (1991) is assumed to have the best properties. The empirical analysis shows that entry stimulates other firms to enter but that exit also increases entry. This means that both the multiplier and the competition effect jointly explain the entry pattern. For exit, on the other hand, the competition effect is the strongest and takes the form such that previous entry creates future exit and previous exit decreases future exit. The finding that exit stimulates entry has important policy implications, since policies aiming at preventing exit might have the effect of decreasing entry. This implies that exit should not always be seen as something negative for the economy but should in many circumstances be regarded as a sign of competition and industrial renewal. Policies aiming at stimulating entrepreneurship and new firm formation, on the other hand, can be expected to be more successful, since the creation of new firms has a multiplier effect that stimulates further entry.

Chapter 4 - "Determinants of Regional Entry and Exit in Industrial Sectors: A Swedish Perspective" has a regional perspective. The industrial entry and exit rates in 81 Swedish labour market regions are compared with the national average for each industry. It is found that on average for the Swedish regions 0.5-2.7 per cent of the entry and exit remains to be explained after adjusting for the national average. However, the regional variation is substantial. There are regions in which many industries perform much worse than the corresponding national average. A one-way fixed effects panel data model is used to estimate the importance of different regional determinants of entry and exit. The analysis is performed at three different levels of aggregation and the pertinent results are compared. To locate close to other firms in the industry (localisation economies) is found to increase the entry rate, but does not prevent firms from exiting. The empirical results also show that the industrial composition in a region is the most important regional characteristic when explaining differences in entry and exit rates across regions.
Chapter 5 - “Exit and Entry over the Product Life Cycle: Evidence from the Swedish Manufacturing Industry”11 which is co-authored by Charlie Karlsson, combines the product life theory with theories about entry and exit. In particular, this essay focuses on how the knowledge intensity of the entering and exiting firms differs between different stages of the product life cycle. According to the product life cycle theory, a higher level of knowledge intensity is necessary in the initial stages of the cycle in order to develop the product, whereas in later stages knowledge intensity can be expected to be lower. When comparing firms that enter in the early stages of the product life cycle with incumbent firms, it turns out that the entering firms are more knowledge intensive. Regarding exit, the empirical results show that firms that exit early in the product life cycle are more knowledge intensive than those that exit in later stages of the product life cycle.

Chapter 6 - “Firm Size, Firm Maturity and Product and Process R&D in Swedish Manufacturing Firms” focuses on the firm’s decision to perform R&D. The major contribution of the paper is that it is possible to distinguish between process and product R&D. In the essay, the probability of performing product R&D, process R&D or combined product and process R&D is estimated, using a multinomial-logit model. The probability of performing R&D is expected to depend on firm demography factors in terms of firm size and firm maturity. The empirical evidence shows that there are substantial complementarities between process and product R&D and that very few firms choose to concentrate only on process R&D. Firms that are older than 80 years, as well as large firms, are found to have a higher probability of performing product R&D and combining process and product R&D. These findings to some extent question the patterns of product and process innovations as described by the product life cycle theory, since they indicate that to be competitive, firms need to continue with product R&D and combine product R&D with process R&D.

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11This essay was published in Small Business Economics, 2002, 21, pp. 135-144.
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1. Introduction and Summary of the Thesis


Chapter 2.
Patterns of Entry and Exit in Industrial Sectors in Sweden

Kristina Nyström

Abstract:
During recent decades, the interest in patterns of exit and entry of firms in industries has resulted in many empirical studies. Most of these studies, due to data availability, usually investigate exit and entry only in the manufacturing industry. This paper intends to give a more complete picture of entry and exit in industrial sectors in Sweden. Data covering all industrial sectors for the period 1997-2001 are used to investigate the patterns of entry and exit. Special emphasis is put on the determinants of entry and exit rates. The importance of profitability, industrial market growth, tangible capital intensity, intangible capital intensity, economies of scale and industry concentration for entry and exit patterns is tested empirically. A one-way fixed effects panel data model is used in the estimation and the results are compared with an estimation using OLS, since OLS is biased and inconsistent if it is used for a fixed effects model. The comparison of the results shows substantial differences between the two methods. The inclusion of unobserved industry-specific effects in the fixed effect model explains many of the inter-industrial differences in entry and exit rates. The empirical evidence shows that investing in intangible assets is a way to compete but also results in increased competitiveness and lower exit rates.

Keywords: entry, exit, industrial sectors, panel data, Sweden
Chapter 3.
Interdependencies in the Dynamics of Firm Entry and Exit

Kristina Nyström

Abstract:
This paper investigates the interdependence between firm entry and exit from an industrial dynamics perspective. The paper discusses how entry and exit rates in industrial sectors are affected by previous exit and entry rates. Economic theory presents two different approaches to how entry and exit of firms are interrelated, the multiplier effect and the competition effect. This paper intends to investigate which force is the predominant one, for entry and exit patterns respectively. The empirical analysis is based on data for 25 Swedish manufacturing industries at the 2-digit SIC level, during the period 1991-2000. In the estimation work the study applies a dynamic panel data approach as suggested by Anderson and Hsiao (1981) and Arellano and Bond (1991). The results are compared with estimations based on OLS and the within estimator. With respect to entry, the empirical results support the multiplier effect such that entry stimulates future entry, but also a competition effect such that past exit induces additional entry. With regard to exit, on the other hand, the competition effect rules, implying that previous entry causes subsequent exit and previous exit reduces subsequent exit.

Keywords: Entry, exit, dynamic panel data
Chapter 4.
Determinants of Regional Entry and Exit in Industrial Sectors: A Swedish Perspective

Kristina Nyström

Abstract:
Recent empirical research by, among others, Audretsch and Fritsch (1999) and Armington and Acs (2002) shows that regional determinants of new firm formation differ between industries. It has also been suggested that a large amount of the regional variation of new firm formation can be explained by differences in industrial structure. This paper reinvestigates the regional determinants of entry and exit considering these findings. The empirical analysis uses data on Swedish firm entry and exit rates for 1997-2001. It is shown that for the country as a whole, on average between 0.5 and 2.7 per cent of the regional variation in entry and exit rates remain to be explained when the regional industrial entry and exit rates are compared with the national average. On the regional level there are substantial variations. The determinants of regional entry and exit are also investigated, using panel data methods at three levels of aggregation, and the results differ slightly depending on the level of aggregation. Agglomeration, in terms of localisation economies, is unequivocally found to be positive for regional new firm formation, but does not necessarily prevent firms from exiting. The results also show that industry structure is a more important explanatory variable for differences between entry and exit rates across regions than regional factors.

Keywords: Entry, exit, industry structure, regions
Chapter 5.
Exit and Entry Over the Product Life Cycle: Evidence from the Swedish Manufacturing Industry

Charlie Karlsson and Kristina Nyström

Abstract:
In this paper the process of exit and entry of firms in the Swedish manufacturing industry is investigated within the framework of the product life cycle. The product life cycle theory explains how the high degree of uncertainty, as regards product designs and production methods, which is connected to the early stages of the product life cycle requires a high level of knowledge-intensity. Since uncertainty decreases over the product life cycle, less knowledge is needed in production during later stages of the product life cycle. This implies that knowledge-intensity differs for firms that exit and enter in different stages of the product life cycle. Four hypotheses regarding these relationships are stated and empirically tested in this paper, using data at the 5-digit SIC-level for the Swedish manufacturing industry during 1990-96. The empirical results show that entrants in the early stages of the product life cycle are more knowledge-intensive than incumbent firms. It is also found that firms exiting in early stages of the product life cycle are more knowledge-intensive than firms exiting in later stages.

Key words: Exit, entry, product life cycle, knowledge-intensity, manufacturing industry

Chapter 6.
Firm Size, Firm Maturity and Product and Process R&D in Swedish Manufacturing Firms

Kristina Nyström

Abstract:
This paper investigates the commonly debated question about innovations and firm age. Are innovations made by incumbent firms, and does innovation therefore constitute a barrier to entry, or is innovation a way for new firms to successfully compete? The paper further investigates the relationship between firm size and innovation. Does innovation constitute a way for small firms to compete or are innovations a large firm phenomenon? In the analysis the paper explicitly distinguishes between product and process innovation. Data from 1997 and 1999 on product and process R&D, firm size and age in the Swedish manufacturing industry are used in the empirical analysis. A multinomial logit model is used to estimate the probability of performing process and product R&D. The results show that there are complementarities between product and process R&D and very few firms conduct only process R&D. The probability of product R&D and combined product and process R&D is higher for large firms and firms that are older than 80 years. Size and age effects are more pronounced for firms that carry out both process and product R&D.

Keywords: Product, process, R&D, firm size, firm maturity
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