**ENTERPRISE SIZE DISTRIBUTION IN THE CROATIAN SOFTWARE INDUSTRY**

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**Abstract**

*Enterprise size is decreasing in recent 20 years. The emergence of large number of micro enterprises is the consequence of the different factors facilitating entry and survival of small and medium sized enterprises (SMEs) as well as the SME policy support in the European Union. In this paper we analyse the firm size distribution in the Croatian software industry. The aim of the paper is to find out if enterprise size distribution varies by age. We analyse several cohorts of enterprises differing by age and we compare their size distribution. Number of employees is used as a size proxy.*

**Key words:** *enterprise size distribution, enterprise age, software industry, Croatia*

**1. INTRODUCTION**

Since the appearance of pioneering works of Pareto  and Gibrat , the distribution of enterprise size has been deeply studied both in the statistical and in the economic literature (Cirillo, 2009). Gibrat's Law (Gibrat, 1931), very popular among researchers, is the first attempt to explain in stochastic terms the systematically skewed pattern of the distributions of enterprise size within industry (Aitchison and Brown, 1957) . Stohastic models indicates that enterprise size distribution is a result of the random walk. Emprical works on the evolution of the enterprise size distribution lead to the conclusion that the inital size distribution of new enterprises is particularly right-skewed but the log-size distribution tends to become more symmetric as enterprises become older (Coad, 2007).

Cabral and Mata (2003) present the facts on enterprise size distribution among Portuguese manufacturing enterprises which support significant right-skeweness evolving over time toward a lognormal distribution. Instead of selection argument affecting market structure, they empahasize the role of financing constraints. Angelini and Generale (2003) confirm the finding of Cabral and Mata that size distrubition of the enterprises is highly skewed to the right at birth and the skeweness diminishes with enterprise age.

Botazzi et al. (2009) explore firm size distribution of French manufacturing enterprises at the aggregate and disaggregate levels and find out that there is a significant enterprise size distributions heterogeneity across industries. Cirillo (2009) analysis the size distribution of Italian enterprises by age and finds out that it is skewed for both young and old enterprises but clearly shifts to the right as time goes by.

In the late 1980s large enterprises started to lose their dominance as a business organization model (Thurik, 2009). Verheul et al. (2002) emphasize the demand side and supply side of entrepeneurship in their eclectic theory of entreprenurship. Both sides are determined by the factors influencing creating and survival of SMEs. Demand side factors such as economic development, technological development, demand diversity, industrial structure and globalization could explain the appereance of entrepreneurial opportunity and entry of many SMEs in the market. Supply side factors also have its important role in creating new opportunities (population growth, population density and urbanization rate, age structure of the population, immigration, participation of women, income levels and unemployment, income disparity). Both demand and supply side factors give help in explaining dynamic processes in new, SMEs dominated ICT service industries, particularly software industry.

Fast growing ICT sector can make a large contribution to economic growth, employment and productivity . Moreover, having a strong ICT sector may help firms that wish to use technology since the close proximity of producing firms might have advantages when developing ICT applications for specific purposes. Effective diffusion and use of technology is a key factor in broad-based growth, particularly when combined with organisational change and effective human resource strategies involving education and training. Future Croatian membership in the EU places emphasis on the importance and need to further develop the information society.

New technologies have reduced the significance of scale economies. Even micro enterprises that successfully implement innovations or are capable to retain their clients can thrive in the growing market. Structural changes, which account for a higher share of services in economies, have opened up new possibilities for entrepreneurship in the service sector.

Considering all the indicators supporting the fact of transition to entrepeneurial economy (Thurik, 2009) the question of the factors influencing the firm size distribution in software industry can be an interesting one.

**2. THE CHARACTERISTICS OF THE SOFTWARE INDUSTRY**

Nambisan (2002) states that the software industry can be considered „the prototypical high technology industry characterized by innovation-driven market growth, rapidly shrinking product and technology life cycles, high knowledge intensity, and global markets“.

The software and software-based services market in EU27 area was about respectable 231 billion Euros in 2009 but European software products are characterized by large economies of scale placing European software vendors at a disadvantage (Rönkkö et al, 2011). As Rönkkö et al. (2010) argue the global software industry is characterized by large variation in enterprise size. There are two reasons for the heterogeneity in software enterprise size distributions: the first one is the absence of entry barriers (supporting micro and small enterprise entry) and the second one is the existence of economies of scale and scope favoring larger enterprises.

Software industry can be devided into two branches: professional services activities and software product activities. Hoch et al. (2000) argue that the scarcity of the talented, competent people is crucial in the software industry. It is also known that the production of information goods characterize low and constant marginal cost (Shapiro and Varian, 1999), but the first copy cost is very high so it could lead to the conclusion that domestic market is small for the software enterprises. In the same time, there is a need for customization because the software product has to be integrated in the specific customer's information systems. ICT service providers are necessary when enterprises need local skills and advice to implement ICT-related changes which could have important role in supporting enterprise growth.

While analysing Croatian ICT sector it was noticed that service industries in ICT sector have no entry barrier regarding minimum efficeient size. Software industry (software supply and software consultancy) and data processing activity have the smallest minimum efficient size among ICT services (Kovačević and Vuković, 2006). The minimum efficient size is usually taken in research as a measure of scale economies or a measure of sunk cost. It can negatively affect entry if a huge output is required for potential entrants to reap the benefits from economies of scale. A small minimum efficient size in most industries in the ICT sector speaks in favour of the conclusion that a smaller minimum efficient size of an industry increases the survival chances of the enterprises in that particular industry.

 If small enterprises or mico enterprises constitute a dominant share in the industrial population, new enterprises have better chances for survival. Industries in the ICT sector are not capital intensive. Instead, , it can be said that ICT industries are human capital intensive (Vuković and Kovačević, 2010) if we take into account average salary as a proxy for human capital. Li et al.(2010) find out in their research that the firms that persist and survive over the long term in the dynamic software industry are able to capitalize on their competitive actions because of their greater capabilities, and particularly operation capabilities.

As entry rates are high, many enterprises start a software business but many of them fail.Hoch et al. (2000) also mention that very few of persons that start a business can run it and most never lead it to the initial public offering. There should be many obstacles to growth: high risk of growth, lack of finance, lack of self-confidence, lack od managerial and entrepreneurial skills, bureacreacy burden, strategical decisions of maintaining the current size of the enterprise.

**3. ENTERPRISE SIZE DISTRIBUTION IN THE CROATIAN SOFTWARE INDUSTRY**

In our research we use Financial agency database which contains longitudinal dana on the panel of all Croatian enterprises in the software industry. Croatian enterprises are required to submit regular financial reports each year. Our analyes is restricted to the software industry. The data for our study relate to the period from 2002-2007 because of the statistical consistency. We consider, first of all, the continuing firms over this period.

We assume that all enterprises, or at least the vast majority of them, have submitted the financial reports regularly so that the sample covers the vast majority of businesses registered for activities in the software industry.

 As ICT has only been recognised as a major source of economic and social change, official statistics on ICT are still under development. International organisations, such as the OECD and Eurostat, have worked together to develop common definitions, common methods and common surveys of ICT. The National Classification of Economic Activities up to the group level (the third level of aggregation) ensures the compatibility with the International Standard Industrial Classification of All Economic Activities ( ISIC Rev. 3.1). We use for our purposes activity 72.2 – software supply and software consultancy as a proxy for software industry.

Our sample of enterprises for which we detected the year of establishment and the number of employees can be traced to the period 2002 to 2007. The total number of enterprises in 2002 was 764 and in 2007 it increased to 1430 (see Table 1). The total number includes both employer enterprises (with at least one employee) and the non-employer enterprises (enterprises without employers).

|  |  |
| --- | --- |
| Year | Number of enterprises |
| 2002 | 764 |
| 2003 | 892 |
| 2004 | 995 |
| 2005 | 1125 |
| 2006 | 1278 |
| 2007 | 1430 |

**Table 1**. Number of enterprises in the Croatian software industry in the period 2002-2007

Source: Financial agency database

The oldest enterprises in our sample were founded in 1989. Late 1980s are the time that we could mark as the beginning of a transition from a planned to a market economy. But the number of businesses established in 1989 which survived to date is small, only 5 of them. The second oldest cohort is the cohort 1990 that counts 27 surviving enterprises. Table 2 provides an overview of surviving enterprises by age cohort. Since we do not know the entry rate in the year of establishment it is difficult to make conclusions about the success of the cohort in terms of survival. However, nearly doubled number of enterprises in the period 2002 to 2007 confirms the previously mentioned claims of a small efficient size in the software industry in Croatia, absence of entry barriers, human capital intensity and probably the increase in demand for software applications and services.

|  |  |
| --- | --- |
| Year of foundation | Number of survivedenterprises in 2007 |
| 1989 | 5 |
| 1990 | 27 |
| 1991 | 27 |
| 1992 | 55 |
| 1993 | 54 |
| 1994 | 63 |
| 1995 | 15 |
| 1996 | 26 |
| 1997 | 20 |
| 1998 | 36 |
| 1999 | 28 |
| 2000 | 15 |
| 2001 | 51 |
| 2002 | 39 |

**Table 2.** Number of survived enterprises

Source: Financial agency database

We analyse enterprise size distribution as well as the evolution of the enterprise size distribution in two ways. Firstly we can analyse enterprise size distribution in different years. The second way is to group enterpries according to the age criteria and see the changes in enterprise size distribution as they get older. We use the number of employees as a size proxy. We excluded the enterprises without employees from the enterprise size distribution analysis because from the social point of view only the employer enterprises (with at least one employee) contribute to the social and economical improvement, especially in the period of increasing unemployment rate. However, the excluded group of enterprises (non-employer enterprises) is significant, it counts about 20% of the whole population in 2002 and increases to 47% in 2007.

|  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- |
| Year | N | Mean | Min | Max. | Std. Dev. |
| 2002 | 604 | 4,74 | 1,00 | 94,00 | 7,84 |
| 2003 | 617 | 4,66 | 1,00 | 112,00 | 8,20 |
| 2004 | 608 | 5,40 | 1,00 | 118,00 | 10,67 |
| 2005 | 641 | 5,46 | 1,00 | 116,00 | 10,57 |
| 2006 | 698 | 6,14 | 1,00 | 296,00 | 15,58 |
| 2007 | 756 | 6,65 | 1,00 | 311,00 | 17,12 |

**Table 3.** Descriptive statistics on enterprise size in the period 2002-2007, enterprise size measured by number of employees

We notice that the number of employer entrprises is increasing (with exception of 2004). In 6 year long period the total amount of employer enterprises increased from 604 to 756, in this period 152 additional enterprises have appeared in the industry. It is also obvious that the average software enterprise has also become bigger, according to the mean value (from average size of 4,7 employees per enterprise in 2002 to 6,6 employees per enterprise in 2007). The reason for such trend is the mobility of enterprises in terms of change of their size. Several enterprises have grown rapidly and left behind the rest of the population. The average size is also influenced by the extreme values in the population, entry of enterprise with 311 employees in 2006 influenced the skewness and kurtosis significantly (Table 4).

|  |  |  |
| --- | --- | --- |
| Year | Skewness | Kurtosis |
| 2002 | 6,10 | 51,77 |
| 2003 | 7,03 | 69,40 |
| 2004 | 6,18 | 47,18 |
| 2005 | 6,02 | 45,49 |
| 2006 | 11,21 | 180,53 |
| 2007 | 9,95 | 144,31 |

**Table 4.** Descriptive statistics on skewness and kurtosis in different years

Enterprise size distribution in observed industry is strongly right- skewed. It is indicated by the positive values of the skewness parameter. High values of the kurtosis indicators provide evidence of the existence of fat or heavy tails.

Figure 1 presents the kernel denisty estimate (following Silverman, 1986) of enterprise size distribution in the Croatian software industry in 2005. We use log values of enterprise size (measured by number of employees). Kernel density estimate is a smoothed version of the histogram. Figure reveals the existence of many micro- and small enterprises and just a few medium and large sized enterprises.



**Figure 1**. Kernel estimates of the density of enterprise size in 2005

The following analysis refers to the enterprise size related to the enterprise age. Population of enterprises that survived from 2002 to 2007 are grouped according to the age criteria (Table 4). It can be generally observed that average enterprise size increases with enterprise age. Since we excluded from our observation enterprises without employees, the smallest enterprises in our sample are those with at least one employed person. The prevalence of enterprises with one employee indicates the persistance of micro-enterprises category in the population of enterprises in the observed industry.

|  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- |
| Age group  | N | Mean | Mode | Frequency of Mode | Min | Max | Std. Dev. |
| All enterprises | 755 | 6,64 | 1 | 270 | 1,00 | 311,00 | 17,13 |
| Age ≤ 1  | 171 | 5,24 | 1 | 89 | 1,00 | 311,00 | 24,48 |
| Age 2-4  | 171 | 7,40 | 1 | 55 | 1,00 | 110,00 | 16,82 |
| Age 5-9  | 127 | 7,08 | 1 | 42 | 1,00 | 80,00 | 11,83 |
| Age 10-15  | 226 | 6,09 | 1 | 74 | 1,00 | 134,00 | 12,90 |
| Age ≥16  | 60 | 9,58 | 1 | 10 | 1,00 | 120,00 | 16,09 |

**Table 4**. Enterprise size distribution by age cohort, 2007.

Statistical dana on skewness (Table 5) confirm previously mentioned claims that the inital size distribution of new enterprises is particularly right-skewed.

|  |  |
| --- | --- |
| Age group | Skewness |
| Age ≤ 1 | 9,56 |
| Age 2-4 | 4,66 |
| Age 5-9 | 3,80 |
| Age 10-15 | 6,45 |
| Age ≥16 | 5,69 |

**Table 5.** Descriptive statistics on skewness and kurtosis according to the enterprise age group

Generally, statistical dana confirm right-skeweness of enterprise distribution and the existence of fat or heavy tails in the case of the Croatian software industry.

**CONCLUSIONS**

Analysis of the population of enterpries in the software industry in Croatia shows that the sector is predominantly made ​​up of micro enterprises. Micro-size is a pesistant category, we notice that only one group of enterprises over 16 years is approaching the average size of 10 employees per enterprise. It is the group of enterprises aged 16 years and older. The study supports previous empirical research on the stochastic distribution related to enterprise size. Also in line with research is the existence of right-skewness and fat tails.

Since the distribution is analyzed based on enterprise size measured by only one measure: the number of employees, in the next step of research we should definitely make an analysis of the size distribution measured in total sales and profits.

The software industry in Croatia consists of a dynamic population that clearly characterize the dynamic processes of entry, exit and mobility of enterprises, so that aspect of the business dynamics should be analysed as well as the growth process of the enterprises.

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