How Fast Can Firms Grow? Author(s): Johann Peter Murmann, Jenny Korn and Hagen Worch Source: Jahrbücher für Nationalökonomie und Statistik / Journal of Economics and Statistics, Vol. 234, No. 2/3, Themenheft: Frontiers in Evolutionary Economics (April 2014), pp. 210-233 Published by: Lucius & Lucius Verlagsgesellschaft mbH Stable URL: http://www.jstor.org/stable/24614937 Accessed: 04-03-2017 22:02 UTC

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# How Fast Can Firms Grow?

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JEL D22; D92; L25 Organizational growth; organizational size; evolution.

# Summary

Building on recent research on dynamic, high-growth firms – so-called "gazelles" – this paper explores a simple question that is important in both theoretical and practical terms: What is the fastest rate at which firms can grow? Based on a sample of seven high-growth firms (Cisco, GM, IBM, Microsoft, Sears, Starbucks, and US Steel), we find that 162% is the maximum sales growth rate in any one year that an established company can grow without mergers and acquisitions, while the maximum rate of employee growth is approximately 115% even including some mergers and acquisitions. All of the companies in our sample attained a maximum sales growth rate of above 50%, with most hovering around 75%. Furthermore, the firms' growth rates exhibit similar patterns. No company experienced its maximum sales growth rate after attaining its maximum employee growth rate, usually within a decade of one another. Most importantly, all firms show an average sales growth that exceeds the average employee growth. This finding is an indication that successful growing firms have a superior capability to continuously improve employment efficiency and adjust organizational structures to suit an increasing workforce.

# 1 Introduction

The term "gazelles" has recently become common in the entrepreneurship literature to describe firms that enjoy rapid growth (e.g., Acs/Mueller 2008; Parker et al. 2010; Henrekson/Johansson 2010). However, just as the term suggests, most of these firms reach the limits of growth after a short period of time (Parker et al. 2010). Despite the prominent attention such firms have received from scholars, management practitioners and policymakers over the years, many questions about the nature of their growth and the possibility of sustaining it remain unanswered (Stam 2010).

<sup>\*</sup> We would like to thank the anonymous reviewer for suggestions about how to improve the paper and Salih Ozdemir for help with Figures 1 and 3.

Continuously growing firms are those that manage to repeatedly discover, develop and explore new opportunities, and are also able to overcome phases of temporary decline. They constantly expand their range of activities and gain a robust standing in their market environment, which allows them to grow further. However, the exact factors that distinguish continuously growing firms from others are only partially understood. This paper sheds light on some of the open aspects of firm growth, which has been an important agenda of Ulrich Witt (1998, 2000, 2007). We look at large firms that have successfully grown over longer time periods and describe their growth paths in order to develop a more fine-grained understanding of continuous growth.

Scholarship on organizations has flourished over the past 50 years but, to our knowledge, no handbook summarizing key descriptive statistics on the development of organizations has been assembled. Such descriptive data would enable scholars of organizations to refine their theories because they would be able to more readily ascertain whether large and small organizations operate according to similar or different principles. Such descriptive statistics would also be valuable to managers in determining how quickly and how large they can grow their organizations without jeopardizing viability and performance. It would also be of immense value to identify the maximum growth capability of firms in order to develop appropriate public policy for governmental agencies. If an individual firm's growth is limited, rapid economic growth can only be achieved if multiple firms exist in a sector. Given that we presently lack descriptive data that address the important question of how quickly an organization can grow, we have studied the growth pattern of seven firms that realized continuous growth over long time periods and became very large: Cisco, General Motors (GM), IBM, Microsoft, Sears, Starbucks, and US Steel. The seven firms in our sample were chosen to represent diverse industries.

In other branches of sciences, collecting descriptive data on the objects of study is an important preparatory task for developing good theory. Anthropologists and medical scientists, for example, began by collecting descriptive data that define human characteristics before developing theories about the species. Detailed information on average growth rates, the sizes of the tallest and smallest individuals who have lived into adulthood, etc., are very important data that can be used to identify abnormal growth of a particular human being and potentially recommend hormonal treatment. To understand the proper functioning of key organs, it is important to obtain information that relates organ size to the overall size of a human body.

Researchers have found that humans grow at different rates in different phases of life. In general, the velocity of growth decreases from birth onward (and actually from as early as the fourth month of fetal life), but this decrease is interrupted shortly before the end of the growth period. From birth until age four or five, the rate of growth in height declines rapidly, and then the deceleration gradually becomes less. Then there is a marked acceleration of growth between age 13 and 15 years called the adolescent growth spurt. As a result, some children's growth rate is practically constant from the age of five or six until the beginning of the adolescent spurt. A slight increase in velocity is sometimes said to occur between six and eight years.<sup>1</sup> These boundaries allow researchers to forecast the likely growth rate for humans based on past patterns for a particular population and phase.

<sup>&</sup>lt;sup>1</sup> http://www.britannica.com/eb/article?eu=119861&hook=526690#526690.hook.

In principle the growth rates and development patterns of firms can be studied in the same way anthropologists and medical researchers study the growth and development patterns of human bodies. Some theoretical research has been done on the growth patterns of individual firms and general patterns of firm growth in organizational populations (e.g., Langlois/Robertson 1995; Witt 1998, 2000, 2007; Cordes et al. 2008; Cordes et al. 2010; Baaij et al. 2011). But to the best of our knowledge, no one has conducted a systematic empirical study to collect descriptive data of firms that have experienced successful growth over many years and decades.

Even the literature on gazelles has mostly focused on identifying factors that determine fast growth rather than on examining patterns of firm growth. Putting the insights about growth factors in the recent gazelle literature into the larger context of the lifecycle approach (Tushman/Romanelli 1985) and developmental theory of the firm (Witt 2000) may enable scholars to better determine in what phase of a firm's development fast growth is likely to occur. Collecting descriptive data about organizational growth is a crucial first step toward such an integration and further theory development.

Unlike human growth, where we know that growth in no other development period is likely to be faster than the adolescent growth spurt, organizational researchers have yet to explore systematically whether firms have identifiable periods of growth and maximum growth rates. Scholars have hypothesized that firm growth rates are affected by several factors, including firm size, firm age, human capital, organizational efficiency and pure chance, but they have not collected systematic information on the average and maximum growth rates of firms.

This paper takes a step in this direction through a study of minimum, average and maximum growth rates among the seven companies in the sample. Having identified peaks and troughs in their growth rates, this paper further examines whether the changes in the growth rates show characteristic patterns. The results of this analysis allow us to develop a better understanding of the growth phenomenon. Our approach of studying very large firms in particular may provide insights on the highest growth rates possible beyond the first few years of a company's life, and therefore expose the range of the upper boundaries of firm growth. The descriptive data presented in this paper may serve as a starting point for developing a theory of firm growth and formulating hypotheses about the development patterns of growing firms. Our paper thus contributes to ongoing efforts to develop theory of firm development inspired by evolutionary economics (cf. Witt 1998, 1999, 2007).

The paper proceeds as follows. We first review previous theoretical and empirical research on firm growth rates, which leads to the conclusion that we lack knowledge about maximum growth rates and growth patterns of established firms (i.e., companies that are at least a few years old). To fill this gap in the existing literature, we then present historical quantitative data that we collected on fast-growing firms that became very large. The actual growth rates of the seven companies in our sample provide an estimation of the rate of growth across industries, age, organizational design, and other factors. Finally, we discuss the implications of the findings for theory building, future research, and management practice. The descriptive data are not only important for determining scale and scope conditions of organization theories, but also very useful for managers. They offer yardsticks that make it possible to determine bottlenecks (stagnant growth) and opportunities (increased growth) for individual firms. Furthermore, the data are beneficial to public policymakers because they provide one important reference criterion for deciding whether to support a specific company or facilitate the creation of multiple firms.

# 2 Analysis of the theoretical and empirical literature: factors influencing firm growth rates

There is a large number of publications about the various factors that influence the growth of organizations (cf. Sutton 1997; Caves 1998). We have analyzed this literature to learn about how quickly firms can grow. Research on firm growth spans many industries and countries and in recent years the number of articles on firm growth has grown substantially (Coad 2009).

In addition to reviewing a broad literature spanning the past few decades, we examined very closely a sample of 162 articles written in the past three years on firm growth. We searched the term "firm growth" in the ABI/INFORM database fields for title, abstract and subject heading. This yielded 255 articles. Upon closer examination, 162 articles were deemed to be true contributions to the literature on firm growth. Based on this review we found that firm size, firm age, human capital and organizational efficiency had been identified as determinants of firm growth rates. 123 articles explored human capital as a factor of firm growth, followed by 23 articles on firm size, ten on firm age and six on organizational efficiency. See Table 1 for a summary of the factors of firm growth by number of articles. The factors are discussed in detail below.

Past research has pointed out that growth prediction is extremely difficult and that chance plays a significant role in determining a firm's fate (Goronzy et al. 1974). Davidsson (1991) concluded from empirical investigations that indeed a large number of factors affect firm growth. More recently, however, scholars have accounted for more diversity in firm growth research, examining a variety of determinants that would predict firm growth. The upsurge in firm growth research reflects an epistemological shift in presuming that firm growth may in fact be predictable. In other words – and in contrast to earlier entrepreneurship research – scholars now believe that firm growth may actually be anticipated, which eliminates chance as an explanation. Thus, the number of published articles in the past three years that point to pure chance as the predictor of firm growth has become zero.

Factors of growth	Number of articles		
Firm size	23		
Firm age	10		
Human capital	123		
Organizational efficiency	6		
Pure chance	0		

Table 1 Firm growth factors by number of articles

# 2.1 Firm size

Following Gibrat's (1931) argument, conventional wisdom held for several decades that expected firm growth rates are independent of firm size. This idea subsequently was called "Gibrat's Law". In the past, many articles dealt directly with "Gibrat's Law", and a substantial number of them limited their research to small firms (Acs/Audretsch 1990; Chakrabarti 1990; Acar 1993; Hay/Kamshad 1994; Merz et al. 1994; Storey 1994a; Chittenden et al. 1996; Greening et al. 1996; Bryson et al. 1997; Barringer/Greening 1998). Other articles focused solely on large firms (Geroski et al. 2000; Kania/McKean

1981). Only a few studies found support for Gibrat's Law in its entirety (Eriksson 1984; Fulton et al. 1995; Greenwald et al. 1990); the overwhelming majority of articles either qualifed or disconfirmed it. Wagner (1992, 1994) found that neither a lognormal relation nor any other systematic relationship existed between firm size and growth. In contrast, most empirical work concluded an inverse relation between firm growth and firm size, such that firm growth decreases as size increases (Kumar 1985; Evans 1987a, 1987b; Cabral 1995, 2003; Das 1995). Dunne and Hughes (1994) determined that after firms reach a certain threshold of size, Gibrat's Law proves true; that is, Gibrat's Law holds only for larger firms. Other scholars noted that growth occurs faster for smaller companies (Mata 1994; Orser et al. 2000).

The majority of papers in the past three years confirm these findings and refute Gibrat's Law. In fact, only six of the 23 articles from our sample agreed that growth rates were independent of firm size (Choi 2010; Giotopoulos/Fotopoulos 2010; Luttmer 2011; Malevergne et al. 2010; Mateev/Anastasov 2010; Reichstein et al. 2010). Generally, research from the past three years shows that smaller firms tend to grow more quickly (Arellano et al. 2012; Coad/Tamvada 2012; Fotopoulos/Giotopoulos 2010; Kiani et al. 2012; Kosová/Lafontaine 2010; Nkurunziza 2010; Park et al. 2010; Piergiovanni 2010). Within this subset of research showing faster growth rates for smaller firms, the same studies also showed that younger firms grew faster (Coad/Tamvada 2012; Kosová/Lafontaine 2010; Park et al. 2010; Park et al. 2010; Piergiovanni 2010).

# 2.2 Firm age

One might conjecture that, as is true of human development, a firm's growth slows as it ages. Jovanovic (1982) first proposed this inverse growth-age relationship in his theory of firm learning (Storey 1994a). The overwhelming majority of the articles about firm-age relations support his idea. Evans (1987a, 1987b), McPherson (1996), Pelham and Wilson (1996), and Stevenson and Jarrillo-Mossi (1986) all concluded that as companies age, their rate of growth decreases, contributing to a stabilization of industry concentration (Davies/Geroski 1997). Some research, however, indicates that in an infant industry, age positively impacted growth in young firms (Das 1995). If this is the case, it seems that age only becomes negatively related to firm growth in a more mature phase of an industry. Nevertheless, growing firms generally tend to be younger companies, while firms in decline are comparatively older (Orser et al. 2000; Klepper/Graddy 1990). Acar (1993) is the only scholar who found that firm age was not a significant factor explaining size or performance.

All articles that explored the relationship between firm growth and firm age during the past three years found that Jovanovic's rule applied (Bonaccorsi/Giannangeli 2010; Capasso/Cefis 2012; Chan et al. 2011; Coad et al. 2011; Huynh/Petrunia 2011; Khan/Siddiqi 2011; Lee 2010; Moreno/Castillo 2011; Pervan/Kramaric 2012; Yazdanfar/Salman 2012). In other words, the pattern of younger firms growing quickly but then more slowly as they age is consistently found in recent empirical literature.

# 2.3 Human capital

Most research on firm growth has focused on how human capital affects firm development. Human capital consists of such properties of individuals as personal skills, capabilities, experience and knowledge. One of the most influential contributions on the relation between human capital and firm growth is Penrose's (1959) theory of the growth of the firm. Penrose (1959) proposed that firm growth is limited by an organization's bounded human capital, and therefore managerial resources have to grow at a rate somewhat faster than that of the size of the firm (Gander 1991). The growth of managerial resources and capabilities is often seen as a necessary condition for a firm to grow because the availability of managerial resources directs the growth through knowledge acquisition and application (Foss 1998).

Some scholars reacted to Penrose's theory and argued that there are organizational forms that maximize firm growth without requiring as many associated managerial resources. Besides franchising (Shane 1996a, 1996b; Thompson 1994), inter-organizational relationships with other firms (Peng 1997) and cooperative relationships with external organizations termed as "satellites" and "constellations" (Lorenzoni/Ornati 1988) have been studied.

Nonetheless, Penrose's (1959) theory has historically been supported (Kangasharju 2000; Orser et al. 2000; Storey 1994a, 1994b).<sup>2</sup> Factors limiting management appear to confine firm growth. For example, Davidsson's (1991) study shows that differences in managers' ability and perception of the need and opportunity for growth explain a substantial share of the variation in actual and historical growth rates. Top management's risk-taking propensity and willingness to gamble with a firm's success bound firm growth to management's human capital (Covin/Slevin 1998). Information costs also represent a limitation on firm growth (Prescott/Visscher 1980) because dispersed information exacerbates management's limited attention span and increases the difficulty of controlling firms (Gifford 1992).

Building on Penrose (1959), several studies recognized the general importance of managers and their leadership strategies for bringing a firm into growth (Daily/Dalton 1992; Eidson 1993; Kania/McKean 1981; Cornelius 1979; Fergus 1995; Datta/Guthrie 1994; Merz et al. 1994; Penrose 1959). Eisenhardt and Schoonhoven (1990) showed that the size, past experience and heterogeneity of the founding top management teams affect firm growth. Some scholars noted that management could decide to use mergers as a way to attain firm growth, improve company performance and increase organizational profitability (Ikeda/Doi 1983; Rose 1992). Another key to growth besides mergers was management's ability to forge constructive networks, create external relationships, develop useful alliances, navigate government reforms, identify sources of external funding, disclose financial records, achieve vertical integration, and accomplish geographical expansion (Woodward/Dingle 1988; Zhao/Aram 1995; Lane 1995; Demirguc-Kunt/Maksimovic 1998; Shamis/Lewandowski 1996; Levy et al. 1984; Barringer/Greening 1998; Greening et al. 1996). On the other hand, multinational strategies had an inverse effect on growth (Siddharthan/Lall 1982), while cash flow and leverage had indeterminate effects on long-term growth (Hayashi/Inoue 1991; Lang et al. 1996).

Some scholars found that management of human resources, e.g., raising company morale, aligning organizational goals and making decisions about outsourcing, is an important

<sup>&</sup>lt;sup>2</sup> Evidence supporting Penrose's theory came from various articles (Prescott/Visscher 1980; Acs/ Audretsch 1990; Davidsson 1991; Gander 1991; Gifford 1992; Storey 1994a, 1994b; Covin/Slevin 1998; Kangasharju 2000; Orser et al. 2000). The only author whose findings contained a limitation to Penrose's findings was Gander. Gander (1991) found that Penrose's theory holds true for firms he studied within 1977 to 1980, but that firm size and managerial resources grew at commensurate rates for firms from 1983 to 1986.

factor in firm growth (Klaas et al. 2000; Sickles 1999; Baer 1987). Managers who made critical strategic choices relating to technological change and knowledge management could affect firm growth (Iwai 1984; Starr 1988; Kotha/Nair 1995; Hitt et al. 2000). Unionization is a factor that affected firm growth in an unpredictable way. Acs and Audretsch (1990) found that as unionization increases, small firm growth decreases. In contrast, Bronars and Deere (1993) found no evidence of a significant influence of unionization on firm growth.

Other scholars argued that managerial motives, including increased company profits, greater individual compensation, and even improved neighborhood conditions could explain firm growth (Acar 1993; Goronzy et al. 1974; Cubbin/Hall 1983). Scholars also explored management motivation in entrepreneurial companies and concluded that neither task nor hierarchical motivation had any significant effect on growth (Birley/Westhead 1994), while another author (Miner et al. 1989; Miner 2000) stated that task motivation of entrepreneurs had a slight effect on growth. One study found that individual managerial characteristics, including gender, played a significant role in firm growth in developing countries (McPherson 1996).

Similar to earlier research, the factor garnering the most scholarly attention by far in the past three years of firm growth research has been human capital. Following in the footsteps of Penrose, 76% of the articles in our sample focused on how managers matter in affecting firm growth. Human capital manifested in a variety of areas such as building networks and alliances (Baliamoune-Lutz et al. 2011; Bratkovic et al. 2012; Danis et al. 2010; Daskalopoulou/Petrou 2010; Lin et al. 2010; McEvily et al. 2012; Wang/Altinay 2012), maintaining employees' loyalty, morale and satisfaction (Antoncic/Antoncic 2011; Bamiatzi/Sinkovics 2010; Antoncic/Antoncic 2011; Wiley 2011), and learning and acquiring knowledge in technology and innovation (Corsino/Gabriele 2011; García-Manjón/Romero-Merino 2012; Le Bas et al. 2011; Majumdar 2010; Pitelis/Panagopoulos 2010; Stenholm 2011; Tsai et al. 2011) as well as in financing, investments, credits, loans and venture capital choices (Ahmed/Hamid 2011; Ayyagari et al. 2010; Baliamoune-Lutz et al. 2011; Bertoni et al. 2011; Brinckmann et al. 2011; Bushman et al. 2011; Chan 2011; Degryse et al. 2012; Glushkov/Bardos 2012; Hussain et al. 2010; Huynh/Petrunia 2010; Peneder 2010; Ponikvar/Kejzar 2011; Rahaman 2011; Yazdanfar 2012). Judging from recent research, managerial strategies are among the most studied variables affecting firm growth, especially managerial choices in financing firm growth.

# 2.4 Organizational efficiency and the business environment

Dunne and Hughes (1994) found that industry concentration did not matter in the long run as much as efficiency. In contrast, Hay and Kamshad (1994) show that intensity of competition limits firm growth, especially during recessionary periods. However, their analysis is based on management's subjectively perceived intensity of competition, which is different from objectively measured competition. Hay and Kamshad (1994) also find another central factor hindering firm growth, which is the often prevalent problem of management having to deal with increased administrative burdens arising from expansion. Arrighetti (1994) found evidence that efficiency is not as important in firm survival and growth as are individual firm entry modes and growth patterns.

Within the past three years, factors that would have been attributed to organizational efficiency, including individual firm entry, industry concentration and firm competitiveness, have shifted the focus from organizations as a whole to specific individuals such as managers choosing when to enter a market and how to react to changing market shares. Furthermore, organizational efficiency has been analyzed in the context of specific legal and policy constraints (e.g., inflation), which affect the market structure and business environments in which firm growth occurs (Balsmeier/Czarnitzki 2011; Klapper/Love 2011; Kosová/Lafontaine 2010; N'Cho-Oguie et al. 2011; Santarelli/Tran 2011; Schwarzkopf/Farmer 2010).

# 2.5 Taking stock

This analysis of a large number of studies on firm growth revealed that scholars have investigated extensively a large number of factors that in principal can influence firm growth. Yet the literature provides no data on the simple empirical question: What are the minimum, average and maximum rates of growth that historically successful firms have experienced? This question is important for a number of reasons. Managers need to know how fast they can grow their firms under the best circumstances, and public policymakers need to know if they can rely on a single firm to provide products and services in a market that can grow at very high rates. In the following sections we purpose to answer this simple but important empirical question.

# 3 Methodology

For this study, we selected Cisco, General Motors, IBM, Microsoft, Sears, Starbucks, and US Steel because of their historical significance as leading and enduring American companies. Table 2 summarizes the case studies. We obtained their growth data from their public affairs offices,<sup>3</sup> websites, annual reports, the Wharton Research Data Services (WRDS) database, the Center for Research in Security Prices (CRSP) database, Standard & Poor's Security Price Index Record (also known as the "Blue Book" and previously as the Standard Statistics Company Security Price Index Record), the Financial Review, and the Commercial and Financial Chronicle. We also extracted historical data on sales and employee growth from secondary reference materials, which included Roger Smith's (1984) book on GM, David Bunnell and Adam Brate's (2000) book on Cisco, Emerson Pugh's (1984, 1995) books on IBM, James Wallace's (1992) book on the steel industry. The seven companies represent a variety of industries: computer communications equipment, motor vehicles, data processing, pre-packaged software, department stores, food preparation, and steel.

Where available, data begin at the year of the initial public offering (IPO) of each company. In some cases such as IBM and Sears, sales and employee data were only available substantially later than the IPO. For General Motors, we were able to collect data on sales and employees from some years before the IPO.

We should emphasize here that, in their first years of existence, companies starting from a small number of employees may experience growth rates that never appear again and that are substantially larger than the ones that we report here for long-lived firms. For example, two people founded Google in 1997. The third employee was added in 1998.

<sup>&</sup>lt;sup>3</sup> Special thanks to John Armstrong, Manager of Public Affairs, for his support and assistance in obtaining data for US Steel.

Firm	Year of foundation	Year of IPO	Sales data analyzed from	Employee data analyzed from	
Cisco	1984	1990	1990	1991	
General Motors	1897	1916	1910	1910	
IBM	1911	1924	1949	1951	
Microsoft	1975	1986	1986	1986	
Sears	1886	1893	1919	1951	
Starbucks	1971	1992	1992	1993	
US Steel	1901	1903	1903	1903	

Table 2 Description of the case studies

In 1999, the number of employees increased to 40, which is an effective growth rate of 1230%. Such a rate was never achieved again, and Google's median employee growth rate is just a bit higher than Cisco's, which we report here in detail.

# 4 Empirical analyses and results

Growth may be defined in terms of absolute size increase from one year to the next or in terms of percent change between years. This paper focuses on the second indicator, which is the traditional measure of sales growth and employee growth. In the following sections, we present the fastest, slowest and average rates for both sales growth and employee growth, along with standard deviations. Table 3 shows the degree of autocorrelation of sales and employee numbers for each company by presenting autocorrelation coefficients in each firm's time series of sales and employee growth. Table 4 summarizes the sales growth data and Table 5 the employee growth data. Figures 1 and 3 depict the sales and employee growth data, respectively, in box plot.

Table 3 Individual firm time series autocorrelation coefficients

	Sales	No. of employees		
Cisco	0.535	0.069		
General Motors	0.028	0.161		
IBM	0.152	0.154		
Microsoft	0.421	0.603		
Sears	0.126	0.353		
Starbucks	1.034	-0.209		
US Steel	0.068	0.088		

# 4.1 Fastest, slowest and average sales growth

Shortly after its IPO in 1990, Cisco achieved its fastest rate of sales growth at 162.53% in 1991. Cisco's rate outpaced the historical sales growth rate of all other companies that we studied. This high level was possible because the company merged with and acquired at least one company every year since 1993 to achieve growth of over 100% (cf. Cisco corporate website's acquisition summary). Midway in its existence, General Motors reached its fastest sales growth rate of 94.40% in 1947. Starbucks had its fastest

growth rate at 75.63% in 1993, which closely resembled Microsoft's fastest growth rate at 75.12% in 1987 and US Steel's highest growth rate at 72.14% in 1916. However, all three of these rates are less than half the maximum sales growth rate of Cisco. IBM experienced its maximum growth rate of 141.88% in 1950. Finally, the slowest maximum sales growth rate was found in Sears at 54.28% in 1946. Averaging the highest growth rate among the large firms is around 96.57%.

The slowest rates of sales growth in the sample reflected significant contractions in sales. US Steel experienced -47.54% in 1932, the same year General Motors reached its slowest rate of sales at -46.55%. Similar in magnitude, Sears' slowest growth rate was -35.99% in 1995. IBM shared a negative minimum sales growth of less magnitude at -6.12%. In contrast, relative newcomers Microsoft, Starbucks, and Cisco all maintained positive minimum sales growth at 23.87% in 1994, 28.38% in 1999, and 31.34% in 1998, respectively.

On average, Cisco sustained phenomenal sales growth at 88.12% with the largest standard deviation of 43.48%. Starbucks also had impressive average sales growth at 53.37%with a standard deviation of 18.01%, followed by Microsoft's average sales growth at 43.13% with a standard deviation of 15.62%. Both IBM's average sales growth of 16.05% with a standard deviation of 21.01% and General Motors' average sales growth of 13.30% with a standard deviation of 26.86% were about double US Steel's average sales growth of 6.68%, the lowest average sales growth in our sample, with a standard deviation of 21.11%. Close to US Steel's average sales growth was Sears at 7.72% with a standard deviation of 12.94%. Averaging the average sales growth rates across the seven companies results in a growth rate of 32.62% with a standard deviation of 22.72%.

Company	Fastest Sales Growth Rate		Slowest Sales Growth Rate		Average Sales Growth Rate	
	Growth rate	Year	Growth rate	Year	Growth rate	Standard deviation
Cisco	162.53%	1991	31.34%	1998	88.12%	43.48% (largest st.d.)
IBM	141.88%	1950	-6.12%	1991	16.05%	21.01%
General Motors	94.40%	1947	-46.55%	1932	13.30%	26.86%
Starbucks	75.63%	1993	28.38%	1999	53.37%	18.01%
Microsoft	75.12%	1987	23.87%	1994	43.13%	15.62%
US Steel	72.14%	1916	-47.54%	1932	6.68%	21.11%
Sears	54.28%	1946	-35.99%	1995	7.72%	12.94% (smallest st.d.)

Table 4 Sales growth rates

The specific sales rates for Cisco, General Motors, IBM, Microsoft, Sears, Starbucks, and US Steel are depicted in Figure 2.



**Figure 1** Median (line within box), 25th percentile (lower end of box), 75th percentile (upper end of box), upper and lower adjacent values (lowest and highest horizontal lines), and outliers (individual dots) of sales growth rates per company. For a more detailed explanation of the figures, see http://jpm.li/14.



Figure 2 Sales growth rates

# 4.2 Fastest, slowest and average employee growth

Of the companies we examined, the fastest employee growth rate occurred in Cisco at 114.93% in 1996. Because Cisco engaged in firm acquisitions in 1995 and 1996, adding employees from other firms in part drove this growth rate. General Motors achieved impressive employee growth shortly after the IPO at 93.17% in 1918. Starbucks' largest change was also impressive at 87.66% in 1995, followed by IBM's fastest employee growth rate of 71.88% in 1964. At about a quarter less, Microsoft's highest employee growth rate was 57.50% in 1987, rising above US Steel's rate of 32.23% in 1916. The fastest employee growth rate of Sears was 14.70% in 1957, making it the lowest among the companies studied.

Of the companies we surveyed, the lowest minimum rate of employee growth was General Motors at -34.90% in 1921, followed by US Steel at -28.47% in 1921. IBM and Sears had comparable minimum employee growth rates of -15.03% in 1993 and -11.04% in 1995, respectively. In contrast, Starbucks and Microsoft maintained positive minimum employee growth rates of 4.00% in 1998 and 5.73% in 1994, respectively. Cisco's slowest employee growth rate was a stunning 25.26% in 1997.

Our data show that the average employee growth rate decreases with the age of the company. At the same time, the standard deviation tends to decrease with age as well. Cisco – as the youngest firm in the sample – led in average employee growth rates with 65.57%with the largest standard deviation of 29.09%. Microsoft and Starbucks, the two other young firms in the sample, also had high average employee growth rates and large standard deviations. Starbucks attained a strong average employee growth rate of 49.21%with a standard deviation of 28.59%. Microsoft had an average employee growth rate of 29.00% with a standard deviation of 17.38%, which was less than half Cisco's rate. The four remaining companies, founded between 1886 and 1911, had lower but still substantial average employee growth rates combined with lower standard deviations.<sup>4</sup> Dropping precipitously from the aforementioned rates, IBM had an average employee growth rate of 5.95% with a standard deviation of 14.91%. Similarly, General Motors

Company	Fastest Employee Growth Rate		Slowest Employee Growth Rate		Average Employee Growth Rate	
	Growth rate	Year	Growth rate	Year	Growth rate	Standard deviation
Cisco	114.93%	1996	25.26%	1997	65.57%	29.09% (largest st.d.)
General Motors Starbucks IBM Microsoft US Steel Sears	93.17% 87.66% 71.88% 57.50% 32.23% 14.70%	1918 1995 1964 1987 1916 1957	-34.90% 4.00% -15.03% 5.73% -28.47% -11.04%	1921 1998 1993 1994 1921 1995	5.78% 49.21% 5.95% 29.00% -0.56% 1.77%	21.77% 28.59% 14.91% 17.38% 11.14% 6.24%

Table 5 Employee growth rates

<sup>4</sup> Note that because of data limitations the average employee growth rates for these four companies were calculated starting several years after the foundation of the companies – in the cases of IBM and Sears substantially later.



**Figure 3** Median (line within box), 25th percentile (lower end of box), 75th percentile (upper end of box), upper and lower adjacent values (lowest and highest horizontal lines), and outliers (individual dots) of employee growth rates per company.

had an average rate of 5.78% with a standard deviation of 21.77%. Sears had an average employee growth rate of 1.77% with the lowest standard deviation of 6.24%. One company had a negative average employee growth rate, namely US Steel at -0.56% with a standard deviation of 11.14%. Averaging the average employee growth rates across the seven companies results in a growth rate of 22.39% with an average standard deviation of 18.45%.

The specific employee rates for Cisco, General Motors, IBM, Microsoft, Sears, Starbucks, and US Steel are depicted in Figure 4.

# 5 Discussion

# 5.1 Sales growth

Cisco, Starbucks, and Microsoft maintained relatively high and consistently positive sales growth rates for multiple years. In contrast, IBM, General Motors, Sears, and US Steel experienced periodically negative and more widely fluctuating sales growth rates. All of the companies in our sample attained maximum sales growth rates above 50%, with most hovering around 75%. No company achieved its maximum sales growth rate toward the latter part of its history. Except for General Motors, all companies experienced their slowest sales growth rates in years subsequent to their maximum sales growth rates. (This



Figure 4 Employee growth rates

is still true for GM in recent years because the large drop in sales from 2008 to 2009 was not as large in percentage terms as in 1931–1932.) However, the span of average sales growth rates was very wide, between 6% and 88%. The four oldest companies have substantially lower average sales growth rates than the other three, and nowhere near the total average sales growth rate of 32.62% across all firms.

# 5.2 Employee growth

Five companies in our sample – Cisco, General Motors, IBM, Starbucks, and Microsoft – displayed high maximum employee growth rates of 57% and higher. Three of these companies represented the youngest companies in the sample. Cisco led the pack in terms of fastest employee growth rate. All companies experienced their slowest employee growth rate after attaining their maximum employee growth rate, usually within a decade of one another (IBM and Sears took 30 and 40 years, respectively). Similar to the sales growth rates, the younger firms Cisco, Starbucks, and Microsoft maintained the highest average employee growth rates at 65.57%, 49.21% and 29%, respectively. On the other hand, General Motors, Sears, and US Steel consistently displayed lower average sales and employee growth rates, and experienced a wider range of fluctuating growth rates.

# 5.3 Some emerging patterns

The younger generation of companies (Microsoft, Starbucks, and Cisco) experienced their fastest sales growth rates within a few years of their IPOs, possibly because they raised resources through the IPOs. In contrast, the four older companies (US Steel, General Motors, Sears, and IBM) experienced their maximum sales growth rates about midway

through their existence, which points to a cresting effect. In addition, though the four older-generation companies in our sample were operating during the Great Depression in the 1930s, none of them experienced their minimum employee growth rates during that period. In contrast, the older companies Sears and IBM both experienced their minimum sales and employee growth rates in the 1990s, the same decade that contained the slowest sales growth rates of the younger companies, Microsoft, Starbucks, and Cisco. It is worth noting that even Microsoft and Cisco, which provide software and infrastructure for the Internet era and belong to the younger group of firms in the sample, could not maintain their previous high level of growth rates.

About half the companies in our sample attained maximum sales and employee growth rates through partnerships with other companies. Surprisingly, Cisco's fastest sales growth rate of 165.23% in 1991 was not attributed to mergers and acquisitions, which became its key growth strategy after 1993. Similarly, General Motors after its initial formation experienced no boost from partnering with other companies through mergers, acquisitions, or joint ventures until the early 1980s, despite reaching its fastest sales growth rate of 94.40% in 1947. Likewise, Sears' first acquisition was in 1981, but its maximum sales growth rate was nearly 35 years earlier in 1946 at 54.28%. About fifteen years after it was founded in 1901 through a merger of many companies, US Steel accomplished its fastest sales and employee growth rates of 72.14% and 32.23%, respectively. In contrast to the above companies, which gained their highest sales growth rates without partnerships, IBM benefited from its acquisition of subsidiary Science Research Associates, Inc., a Chicago-based publisher of educational, testing, and guidance materials in 1964, propelling the company to its maximum sales and employee growth rates of 57.28% and 71.88%. Starbucks' fastest sales growth rate of 75.63% in 1993 stemmed from a combination of completion of its IPO and its relationship with Barnes & Noble stores, through which Starbucks gained a monopolistic entryway to reach a complementary target market. Microsoft reached its fastest growth rate of 75.12% in 1987 as a result of the company's first acquisition of Forethought, Inc.

One striking pattern that emerges from the comparison of the seven companies in our sample is that in all cases the average sales growth exceeds the average employee growth. This means all firms in our sample realized a continued increase of employment efficiency. We can infer from this finding that they not only managed to increase permanently their production and sales capabilities, which is a crucial basis for their sustained growth, but they were also able to coordinate the expansions of their workforces. The seven firms appear to have continuously implemented the required organizational adaptations to suit a growing number of employees. In other words, they tend to have superior capabilities in the organization of their workforces to better leverage available human resources.

Inflation could be another explanation for average sales growth rates exceeding average employee growth rates.<sup>5</sup> Even if it only partly explains the higher average sales growth rates, it counteracts the above argument. Thus, an inflation-based effect weakens the conclusion that the seven firms were permanently increasing their employment efficiency and therefore having substantially superior capabilities to manage employee growth. In fact, constantly growing firms may have such superior capabilities, but to a lesser extent than expected without considering inflation.

This paper contributes to one important research stream in Ulrich Witt's broad agenda on an evolutionary approach to economics (Witt 2003), in which the theory of the firm plays

<sup>&</sup>lt;sup>5</sup> We thank an anonymous reviewer for this very valuable comment.

a prominent role (Witt 1998, 2000). Witt highlighted the central role that entrepreneurs and their ability to coordinate firm activities play in an economic theory of the firm (1999). He pioneered the idea that a cognitive dimension is crucial to understanding organizational development (1998). This was a departure from the conventional view of organizational economics, which has focused on transaction costs and optimal sizes rather than the developmental process underlying organizational growth (Rathe/Witt 2001). Entrepreneurs must not only develop a vision of how to run a profitable firm, they also have to convey that conception to the members of their firm (Witt 2007). Conveying the vision of the business is a coordinative task that becomes increasingly difficult as a firm grows. An entrepreneur may address this challenge in various ways, thus presenting a variety of developmental paths (Witt 2000), such as restructuring an entrepreneurial firm and implementing managerial layers to enable firm growth. Other options include selling the firm or muddling through, either of which results in becoming a niche player or exiting the market.

This paper provides some indirect evidence supporting Witt's evolutionary approach to the theory of the firm. Our results show that coordinating constant organizational growth is required to solve the coordination problem of managing a workforce in such a way that the output per staff member is increasing on an ongoing basis, while the number of employees itself is permanently growing. The seven firms tended to mitigate emerging frictions by carrying out adequate structural adjustments. It would be an important topic for further research to look more closely into the relation between firm growth and organizational restructuring, and what role the inspiration of the entrepreneurs and the executive management teams plays.

# 6 Conclusions and future research

Cisco, General Motors, IBM, Microsoft, Sears, Starbucks, and US Steel represented a wide selection of US-based companies from which we extracted sales and employee data to draw general trends about firm growth. Based on Cisco's figures, we draw the preliminary conclusion for companies that have existed for a few years that 162% is the maximum sales growth rate in any one year that a company can grow without mergers and acquisitions, while a rate of employee growth around 115% appears to be the maximum annual employee growth rate even including some mergers and acquisitions. On average the highest sales growth achieved by our sample of seven firms was about 96.57%, and the average highest employee growth was 67.44%. To be more certain that these numbers are accurate estimates of the maximum firm growth rates, it would be valuable to study other fast-growing firms. Since we chose well-known, large firms, we can already say with confidence that the maximum growth rates of firms are clearly limited. We observed one company achieving 162% once. The important conclusion to be drawn from these findings is that any established firm trying to grow by more than 200% per year is unlikely to achieve its goal. Managers need to know that there are clear limits to growth of firms.

On the other end of the spectrum, General Motors showed that a company experiencing a negative sales growth rate as high as -46.55% (-34.90% in terms of employees) can still survive and remain an important player in the economy. However, this tends only to be the case if such a decline is a rare event and not sustained for multiple years. In fact, the age and size of a firm may play an important role in helping a firm to survive a substantial decline.

This study is not without limitations. One is that the sales and employee growth rates of the firms in our sample are observed from the date of their IPO (in two cases even substantially later; in one case a few years earlier). We see this as a major limitation of the study because this means that our findings are applicable primarily to large firms that have already reached a certain size. Our insights may be less relevant to small teams and entrepreneurial new ventures.

Furthermore, high growth rates may be the result of acquisitions but also of delayed growth after some years of low growth rates, e.g., due to a recession. On the other hand, one can argue that even if high growth rates are due to acquisitions and delayed expansions, continuously growing firms are distinct from less successful firms as they are capable of managing these phases of accelerated growth.

Future research is needed to analyze the times when these limits were reached in the context of the broader history of the company and general economy - for example, fastest growth occurred within ten years of founding and slowest growth occurred within the last recession - and then determine whether a general trend for attaining these limits exists. In the future we plan to examine in more detail the conditions under which the fastest growth rates in the history of individual companies were achieved. A study of the history of individual companies from a Penrosian point of view would shed light on the importance of growth of human capital, i.e., the management's ability to assess growth opportunities and overcome bottlenecks through capability building, networking and mergers. It would also enable researchers to study in more detail the limiting effect of a firm's human resources on growth, as Penrose (1959) had argued. Furthermore, a longitudinal data set for a large number of firms from a variety of industries, sizes, classes, maturity levels, and national origins needs to be put together to obtain more accurate overall growth and employee growth rates. This would provide more accurate estimates as to how fast a firm can grow even under the best circumstances, and provide managers as well as policymakers with clear yardsticks of what is feasible. It will also provide an empirical demarcation of the speeds of firm growth, which could someday be explained by a new theory of firm growth.

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