New High Tech Firm Contributions to Economic Growth

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Abstract

This paper examines the new job formation role of small high technology firms, and the resulting contributions to economic growth. There is a rich literature examining the relationship of technological innovation to economic growth but research on new job formation comparing large and small, low and high technology firms is lacking. We use tabulations of the Census Bureau's longitudinal database of all U.S. business establishments to compare job creation of small and large high-tech firms and all other firms from 1998 to 2002. Small high-tech firms increased employment; larger firms reduced employment. This suggests that federal and state entities should recognize the value of small high-tech firms when creating public policy.

Introduction

Economists have long been studying the linkage between technological innovation and economic growth. This research has been driven by Schumpeter's (1934) description of technological innovation as the source of economic growth. From Solow (1957) through Scherer (1984) and Link and Scherer (2005) the literature is rich with many analyses based on a variety of mathematical and statistical models. However, from the practical view, the question rarely treated is: What is the relative contribution to growth made by small compared to large high-tech firms? Kirchhoff (1994, p. 187) raised this question and found that from 1977-78 through 1983-84, the young, high tech firms created a greater percentage increase of net new jobs than did the other categories of young firms. Kirchhoff did not provide, and our search of the economics and business literature failed to reveal, any effort to examine the economic growth contribution of small versus large firms categorized by high and low tech. For this reason, we developed this research to describe the fundamental workings of small versus large high-tech firms.

We also know that the innovative impact of small firms is greater than large firms: Scherer (1980; 1990), and reports from the U.S. Small Business Administration (1995; 1996), showed that major innovations are disproportionately produced by small firms. Studies have found that "in the modern economy, innovation remains largely the work of smaller firms. Though in the aggregate, new technology based firms (NTBFs) spend only a

fraction of what large firms spend on total R&D, they produce more than half of the innovations" (SBA, 1996). This is because "small patenting firms produce 13-14 times more patents per employee as large patenting firms" and "small firm patents are twice as likely as large firm patents to be among the 1% most cited patents" (CHI Research Inc., 2002). Small firms are also the dominant drivers of the radical innovations that define new fields. According to Baumol,

one can offer the plausible conjecture that most of the revolutionary new ideas of the past two centuries have been, and are likely to continue to be, provided more heavily by independent innovators [entrepreneurs] who, essentially, operate small business enterprises. In turn, these innovators, once successful, often establish firms of their own, joining [or displacing] the large enterprises that engage preponderantly in routine innovation (Baumol, 2002)

These small business enterprises, as they become successful, should also contribute disproportionately to job creation.

Interest in measuring actual employment contributions by large and small firms began with the work of David Birch (1979) who was the first to identify the major differences in job creation by small compared to large businesses.He reported that small firms created more net new jobs than large firms from 1969 through 1976. His research was largely rejected by researchers at that time because his findings were contrary to economic research using published data that describes employment in terms of firm size as published in classified data tables. The thinking on this issue gradually changed, beginning 1982 when the National Science Foundation (NSF) and the U.S. Small Business Administration (SBA) released a report by Gellman Research Associates that showed that small firms were more innovative per employee than large firms. (Gellman, 1976). In 1987, Acs and Audretsch showed that small firms were more innovative in industries that are less concentrated, relatively low incidence of unions, fewer small firms, and those industries with relatively high innovation rates but low growth rate (Acs & Audretsch, 1987). In 1989, Phillips and Kirchhoff reported that the average survival rate of start-up firms was much greater than the rate cited in the news media (Phillips & Kirchhoff, 1989). Then, in 1994 Kirchhoff used SBA's longitudinal database to show that among new start-ups, high-tech firms created the greatest percentage increase in employment between 1976 and 1984. (Kirchhoff, 1994). This combination of information generated increased interest by researchers in the small versus large firm job creation evidence and the next ten years saw researchers recognize that small start-up firms create a majority of net new jobs.

Background

Net new jobs have long been accepted by economists and public policy experts as a measure of economic growth. Net new jobs means jobs gained minus jobs lost over a period of time. This is a reasonable measure since measures based on dollars of trade such as gross domestic product are plagued with variations in price inflation overall, within specific industries and/or product segments. This complicates the accuracy of this measure. On the other hand, one employee is one employee year after year unaffected by inflation. So it is logical to use the job creation of industries or other sectors of the economy as a reasonably good measure of economic growth. It also is politically astute to use this measurement since most new employees are also voters. One can argue that increases in employment are evidence that the local politicians are doing well for their constituents. However, net new jobs will also be impacted by population growth and decline.

Almost all start-ups are small firms. The successful firms achieve high rates of growth (Caves, 1998, p. 1959). Caves also notes (p. 1956) that Jackson's (1996) research in Michigan showed that start-up cohort shares of employment rise for eight years. Thus successful firms contribute their initial and growth employment increasing the net new jobs in their annual cohort for eight years even as the number of firms remaining in the cohort decline. Furthermore, this means that the combination of cohort growth and the entry of many new firms within new annual cohorts accumulate a great many net new jobs in the small firm sector. This is the mechanism by which small firms create the largest share of net new jobs. Our major concern herein is whether this mechanism of job creation exists in the high-tech industries.

Defining High-Tech

Although "high-tech" is widely used by news media and stock brokers to describe an industry type, high-tech lacks a widely used, specific, measurable definition. Such a definition is necessary to analyze the formation, growth, decline and closure of high-tech firms and their employment. As an introduction to a definition of high-technology, the U.S. Department of Labor (DOL) quotes a Congressional Office of Technology Assessment document that describes high-technology firms "as those engaged in the design, development, and introduction of new products and/or innovative manufacturing processes through the systematic application of scientific and technical knowledge." But data to operationalize this definition is not available (Hecker, 2005, p. 57).

Building on this definition, the DOL created a definition based upon the following criterion : "The document (sic Congressional Office of Technology) also notes that high technology firms typically use state-of-the-art techniques and, in terms of quantifiable resources, devote a "high" proportion of expenditures to research and development (R&D) and employ a 'high' proportion of scientific, technical and engineering personnel." (Hecker, 2005, p. 57, see also Hecker 1999) The lack of available data led to the following operationalized definition:

"… high proportion of scientists, engineers and technicians (science, engineering and technician occupation intensity) as defined in the Bureau's 1999 study;"

From this statement, DOL defines three different high-tech levels of "science, engineering and technician occupation intensity." These three level are based on a multiple of the average measure of science, engineering and technician occupation intensity. "Level 1 includes the 14 industries in which these occupations (sic science, engineering and technician occupations) accounted for a proportion that was at least 5 times the average (4.9) or greater and constitute 24.7 percent or more of industry employment" (Hecker, 2005, p. 58-59). These 14 industries defined by NAICS numbers are listed in Table 1A. Level 2 is defined by 12 industries in which the high tech occupations were 3.0 to 4.9 times the average. These industries constitute 14.8 to 24.7 percent of total employment and are shown in Table 1B. Level 3 includes 20 industries with a proportion that is 2.0 to 2.9 times the average, that is 9.8 to 14.7 percent of total employment. These 20 industries are shown in Table 1C (Hecker, 2005, p. 60). Industries under 9.8%, we will classify as level 4 industries for our analysis.

Methodology: Data Development

The U. S. Bureau of the Census has developed a longitudinal, establishment by establishment, micro-data file that can be used to trace individual firm dynamics -- formation, growth, decline and closure. This relatively new data source from the U.S. Census Bureau is the Statistics of U.S. Businesses (SUSB) database. It contains individual records for all establishments with one or more employees for every year from 1988 with the data lagging a few years and is updated annually. Each establishment is coded with the identification of its owner. This allows Census to examine business activity by classifying firms or establishments in terms of formation, growth, decline and closure by industry, employment size, and location yielding information on such issues as firm size distributions and job growth for cohorts over extended periods of time.

For a review of the earlier research see: Scherer, F.M. and David Ross. (1990)

Increases in productivity can distort this measure of economic growth. But traditionally, productivity growth has been less that price inflation so that "jobs" are still widely used as the preferred measure of growth.

The results of the 1999 Bureau study are reported in Heckler, 1999.

Census differentiates between establishments and enterprises (firms). An establishment is a place where work is performed. A firm is an owner of establishments. Firms can have multiple establishments. For example, an small automobile dealer may have only one establishment (showroom) whereas a large dealer many have many establishments, even hundreds for national chains.

By the time this paper is presented at BCERC, Census expects data through the year 2004 will be complete.

Table 1A
Level 1 Industries Used in Developing Data for this Analysis (> 24.7% in technology occupations).

NAICS Number	Industry Description	%
5415	Computer systems design and related services	60.2
5112	Software publishers	56.4
5413	Architectural, engineering and related services	51.5
5417	Scientific research and development services	46.4
5181	Internet service providers and web search portals	43.8
3341	Computer and peripheral equipment mfg.	42.9
5161	Internet publishing and broadcasting	38.7
3345	Navigational, measuring, electromedical and control instruments mfg.	34.7
5182	Data processing, hosting and related services	34.3
3364	Aerospace product and parts manufacturing	31.3
3342	Communications equipment manufacturing	29.2
3344	Semiconductor and other electronic component manufacturing	28.7
3254	Pharmaceutical and medicine manufacturing	28.4
5179	Other telecommunications	27.7

To summarize, examination of the industries described in these tables reveals that Level 1 is the most rigorous of the definitions and Level 3 is the least rigorous.

Table 1B
Level 2 Industries (14.8-24.7% in technology occupations).

NAICS Number	Industry Description	%
2111	Oil and gas extraction	21.3
1131-2	Forestry	20.3
3333	Commercial and service industry machinery manufacturing	20.0
3346	Manufacturing and reproducing magnetic and optical media	19.6
3251	Basic chemical manufacturing	18.9
4234	Professional and commercial equipment & supply merchant wholesalers	18.5
3332	Industrial machinery manufacturing	17.9
5416	Management, scientific, and technical consulting services	17.2
3343	Audio and video equipment manufacturing	15.9
2211	Electric power generation, transmission, and distribution	15.7
3252	Resin, synthetic rubber, and artificial synthetic fibers and filaments mfg.	15.3
…	Federal Government, excluding Postal Service *(not used in analysis)*	17.3

Herein, we report on special tabulations obtained from the U.S. Census Bureau's SUSB data to provide descriptive information showing how high-tech firms start, grow or decline and close. We measure how those that are in the small business sector grow slowly or grow rapidly, and, when combined across several hundred thousand firms, how this growth contributes to the growth of the U.S. economy.

We use the U.S. Small Business Administration's definition of small businesses as those with less than 500 employees. Those with 500 or more are large firms. In our analysis, we further break down small firms into two categories, those with 1-99 employees, and those with 100-499 employees. For our classification of high-tech and non-high tech, we use the categorization levels of Hecker (2005), modified as follow: levels 1, 2, and 3 we treat as "high-tech" and level 4 as non-high tech. Controversy has existed over the years on definitions with regard to net job change and firm size. Figures provided by Okolie (2004) point out that differing definitions

can produce differing results. The SUSB Census program uses start period sizing for firm size which is an accepted method of analyzing new job growth.

Table 1C
Level 3 Industries (9.8-14.7% in technology occupations).

NAICS Number	Industry Description	%
5171	Wired telecommunications carriers	14.5
5511	Management of companies and enterprises	14.3
4862	Pipeline transportation of natural gas	13.5
5211	Monetary authorities—central bank	13.3
5172	Wireless telecommunications carriers (except satellite)	13.3
5173	Telecommunications resellers	13.2
5174	Satellite telecommunications	13.1
3353	Electrical equipment manufacturing	12.9
3259	Other chemical product and preparation manufacturing	12.9
3339	Other general-purpose machinery manufacturing	12.6
3336	Engine, turbine, and power transmission equipment mfg.	12.3
3255	Paint, coating, and adhesive manufacturing	12.2
3241	Petroleum and coal products manufacturing	12.0
8112	Electronic and precision equipment repair and maintenance	11.5
5612	Facillities support services	11.3
3253	Pesticide, fertilizer, and other agricultural chemical mfg.	11.2
5232	Securities and commodities exchanges	--
4861	Pipeline transportation of crude oil	10.3
3369	Other transportation equipment manufacturing	10.0
4869	Other pipeline transportation	10.0

Results

From 1998 to 2002, the economy added 5,155,432 net new jobs resulting in an average of over 1 million net new jobs a year. Establishment births outpaced deaths over this period, as the number of establishment increased 230,000.

We divide the results into separate topics based on the tabulation of important issues concerning the job creation of the different sectors. The issues are presented in an order dictated by the logical sequence of the information.

Table 2A shows the results of the distribution of establishment change for five categories of industries listed in the rows: (1) total of all establishments; (2) total non-high-tech establishments; (3) total high-tech establishments; (4) high-tech Level 1 establishments; (5) high-tech level 2 establishments; and (6) high-tech level 3 establishments. The columns divide these establishment numbers into three firm size classes: fewer than 100 employees (small), 100-499 employees (medium), and 500 or more employees (large). Keep in mind that the employment changes shown here are affected by the recession in 2001-2002.

Census restrictions will not allow the data to be used to create information that in any way may reveal specific information on individual establishments.

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The employment numbers recorded in the SUSB file are from data collected every year during the week containing March 12th. The 2001-2002 recession began in late 2000 and continued through the first quarter of 2002.

Table 2A Establishments and Establishment Growth

	Total Establishments				Establishment Growth			
	Total	<100	100-499	>500	Total	<100	100-499	>500
Total	6254920	5005451	307091	942378	45989	22786	8163	15039
Level 1	207699	178667	10073	18959	2721	2130	239	353
Level 2	104583	87430	3752	13401	3893	3284	86	523
High Tech (1+2)	312282	266096	13825	32361	6614	5414	325	875
Level 3	83024	38053	11443	33528	-399	-589	187	3
Level 4	5859613	4701302	281822	876489	39774	17962	7651	14161
Non-High Tech (3+4)	5942638	4739355	293266	910017	39375	17372	7838	14164

Note: All tables showing the "total" number of establishments and the establishment growth are the annual averages for the period 1998-2002. The size labels are firm sizes, not establishment sizes.

Table 2B gives the rate of growth for each category of establishment. The important role of small firms, particularly high-tech small firms, is shown in establishment growth by the data. Note that high-tech overall shows a 2.12% increase whereas all firms combined show only a .74% increase. And, within the high-tech segment, Level 2 stands out with its 3.72% overall growth combining all three firm size categories. On the other hand, Level 3,

Level 4 and all non-high-tech show little growth except in the firm size category of 100-499.

Table 2B: Establishment Growth (percent)

	Total	<100	100-499	>500
Total	0.74%	0.46%	2.66%	1.60%
Level 1	1.31%	1.19%	2.37%	1.86%
Level 2	3.72%	3.76%	2.30%	3.90%
High Tech (1+2)	2.12%	2.03%	2.35%	2.70%
Level 3	-0.48%	-1.55%	1.64%	0.01%
Level 4	0.68%	0.38%	2.71%	1.62%
Non-High Tech (3+4)	0.66%	0.37%	2.67%	1.56%

Table 3A gives total employment. Just over half of all jobs are in small firms. Large firms account for 57.41% of high-tech employment, about 8% above the overall average of 49.37%, and 8.5% higher than the non-high tech large firms' 48.81% (See Table 3D).

Table 3A: Total Employment

	Total	<100	100-499	>500
Total	110961860	40236531	15852875	54785658
Level 1	5146980	1462687	774017	2910277
Level 2	2015519	552051	260143	1201569
High Tech (1+2)	7162499	2014737	1034160	4111845
Level 3	4167291	378922	446354	3348961
Level 4	99632070	37842872	14372361	47324851
Non-High Tech (3+4)	103799361	38221794	14818715	50673812

Table 3B shows growth in employment where it becomes very evident that among high-tech firms, the only source of employment growth occurs in the less than 100 employment firm size category. Unfortunately, the large losses in employment by firms with more than 100 employees converts the total high-tech sector to a loss of employment, -17,860.

Table 3B: Employment Growth

	Total	<100	100-499	>500
Total	1031086	1363127	2722	-337480
Level 1	-42106	68889	-9127	-101869
Level 2	24246	39868	-2997	-12906
High Tech (1+2)	-17860	108757	-12124	-114774

Level 3	-2734	8204	7527	-19154
Level 4	1051680	1246165	7318	-203551
Non-High Tech (3+4)	1048947	1254369	14846	-222705

Table 3C: Share of Total Employment

	Total	<100	100-499	>500
Total	100.00%	36.26%	14.29%	49.37%
Level 1	4.64%	1.32%	0.70%	2.62%
Level 2	1.82%	0.50%	0.23%	1.08%
High Tech (1+2)	6.45%	1.82%	0.93%	3.71%
Level 3	3.76%	0.34%	0.40%	3.02%
Level 4	89.79%	34.10%	12.95%	42.65%
Non-High Tech (3+4)	93.55%	34.45%	13.35%	45.67%

Table 3D: Share of Sector Total Employment

	Total	<100	100-499	>500
Total	100.00%	36.26%	14.29%	49.37%
Level 1	100.00%	28.42%	15.04%	56.54%
Level 2	100.00%	27.39%	12.91%	59.62%
High-Tech (1+2)	100.00%	28.13%	14.44%	57.41%
Level 3	100.00%	9.09%	10.71%	80.36%
Level 4	100.00%	37.98%	14.43%	47.50%
Non-High Tech (3+4)	100.00%	36.82%	14.28%	48.82%

Table 3E shows that small (<100 employees) high-tech firms had employment growth of 5.40% between 1998 and 2002 compared to a 0.93% growth in total employment. By comparison, total of all large firms (>500 employees) experienced a 0.62% job loss over the same period, and high-tech large firms experienced a 2.79% job loss. All medium sized firms (100-499) gained an average 0.02%, while high-tech medium sized firms averaged a 1.17% loss in employment. Non-high tech small firms gained 1.01%, medium sized firms 0.10%, and large firms lost 0.44%. This is also shown in Figure 2

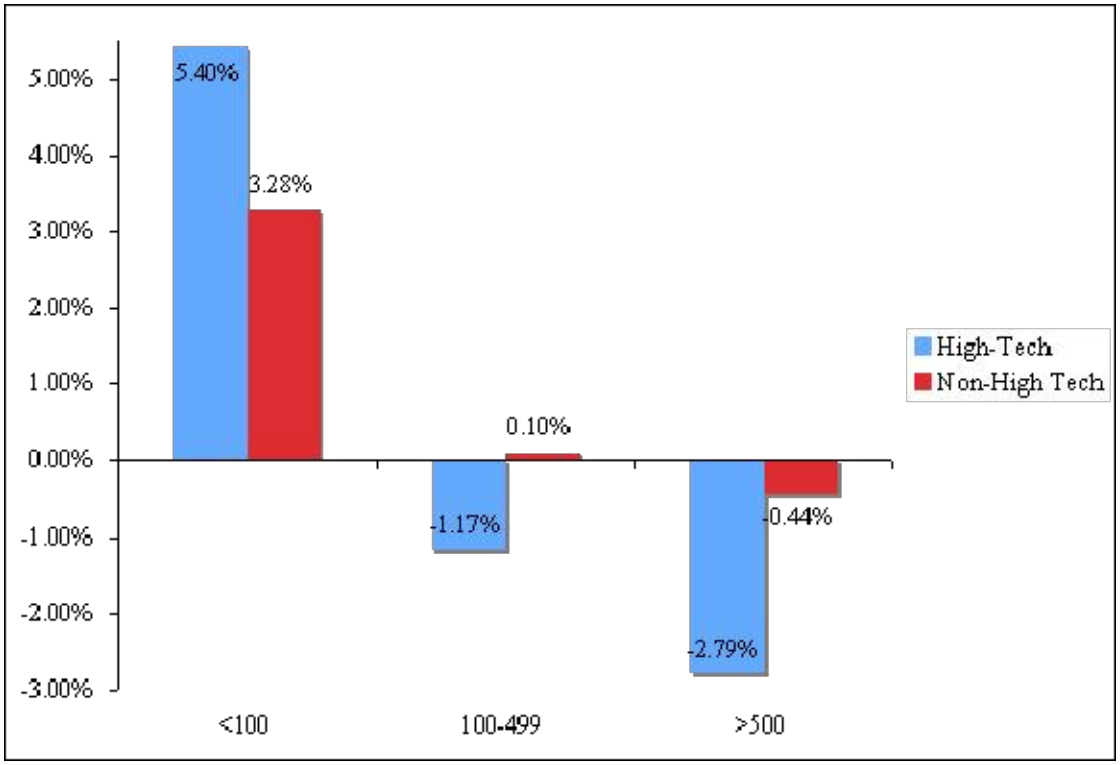
Table 3E: Employment Growth (percent)

	Total	<100	100-499	>500
Total	0.93%	3.39%	0.02%	-0.62%
Level 1	-0.82%	4.71%	-1.18%	-3.50%

Level 2	1.20%	7.22%	-1.15%	-1.07%
High Tech (1+2)	-0.25%	5.40%	-1.17%	-2.79%
Level 3	-0.07%	2.17%	1.69%	-0.57%
Level 4	1.06%	3.29%	0.05%	-0.43%
Non-High Tech (3+4)	1.01%	3.28%	0.10%	-0.44%

These data support the contention that new technology-based firms (NTBFs) are the driving force behind Schumpeter's creative destruction (Schumpeter, 1942; Spencer & Kirchhoff, 2006). Small establishment employment grew with high-tech growing the fastest, and large firms declined with the largest movement in the high-tech sectors. On the other hand, high-tech medium and large firms did not experience this growth showing that the "high-tech recession" caused medium and large high-tech firms to decrease their employment while the small establishments added employment that offsets most of the decline. Table 3B shows that level 1 medium and large firms lost 111,000 jobs while the small firms gained 69,000 to yield a net loss of 42,000 jobs. Thus, no doubt some of those who lost employment at the large firms probably found jobs in small firms.

Figure 2: Employment Growth by Firm Size (1998-2002)



In addition, the percent job creation changes exceed the percent growth in new establishments. As shown in Table 2A, the total number of high tech establishments increased by an average of 2.12%, with an average 2.03%

increase in small establishments, 2.38% increase in medium establishments and 2.69% increase in large establishments. This is relative to the job figures of a 5.40% increase for small, 1.17% decrease for intermediate and 2.79% decrease for large establishments mentioned above. Thus, the increase in employment cannot be attributed to the increase in establishments. However, the increase in small establishments shows that new entries have exceeded closures during these five years but it cannot account for all the new jobs.

Some of the decline in large firm employment may underlie their low rate of establishment growth. In Table 4 high tech firms accounted for 14.38% of all establishment growth. Most of this was small firms – 11.77%. As noted by Jackson (1996) most start up firms add employment for their first eight years and therefore, this formation and growth in small firms establishments boosted their employment growth.

Table 4: Share of Total Establishment Growth

	Total	<100	100-499	>500
Total	100.00%	49.55%	17.75%	32.70%
Level 1	5.92%	4.63%	0.52%	0.77%
Level 2	8.46%	7.14%	0.19%	1.14%
High-Tech (1+2)	14.38%	11.77%	0.71%	1.90%
Level 3	-0.87%	-1.28%	0.41%	0.01%
Level 4	86.49%	39.06%	16.64%	30.79%
Non-High Tech (3+4)	85.62%	37.78%	17.04%	30.80%

Of particular interest is the relative performance of large and small firms in job creation, and whether high tech firms differ from non-high tech firms in this respect. Table 5 shows the shares of total job creation.

Table 5: Share of Job Creation

	Total	<100	100-499	>500
Total	100.00%	132.20%	0.26%	-32.73%
Level 1	-4.08%	6.68%	-0.89%	-9.88%
Level 2	2.35%	3.87%	-0.29%	-1.25%
High-Tech (1+2)	-1.73%	10.55%	-1.18%	-11.13%
Level 3	-0.27%	0.80%	0.73%	-1.86%
Level 4	102.00%	120.86%	0.71%	-19.74%
Non-High Tech (3+4)	101.73%	121.66%	1.44%	-21.60%

It is particularly useful to compare the share of total employment with the share of job creation. Small firms' shares of net job creation were significantly larger than their shares of total employment. Medium and large firms, on the other hand, had much smaller shares of job creation — in fact, mostly negative — compared to their significant shares of total employment. This is illustrated in Figure 3:

It is important to note that the time period for which the data were available included several economic anomalies, including the internet bubble, Y2K (with its associated computing issues), the recession beginning in 2000, and the terrorist attacks of September 11, 2001. It is impossible to say how the data were impacted by these events, and whether these anomalies would have affected the results demonstrated above. However, the small firms consistently outperformed large and medium sized firms across the five-year period; since one would expect these shocks to have different effects, the consistent performance suggests support for generalizing these results to other time periods. Similarly, high tech small firms outperformed non-high tech small firms with the exception of 2001; given that the bursting of the internet bubble and the passing, without incident, of Y2K, would be expected to disproportionately impact high tech industries, this is not surprising. Even in 2001, however, small high tech firms outperformed large high tech firms in job creation, losing about 4% compared to about 10.5% (See Table 6).

Figure 3: Comparison of Employment Share to Job Creation Share

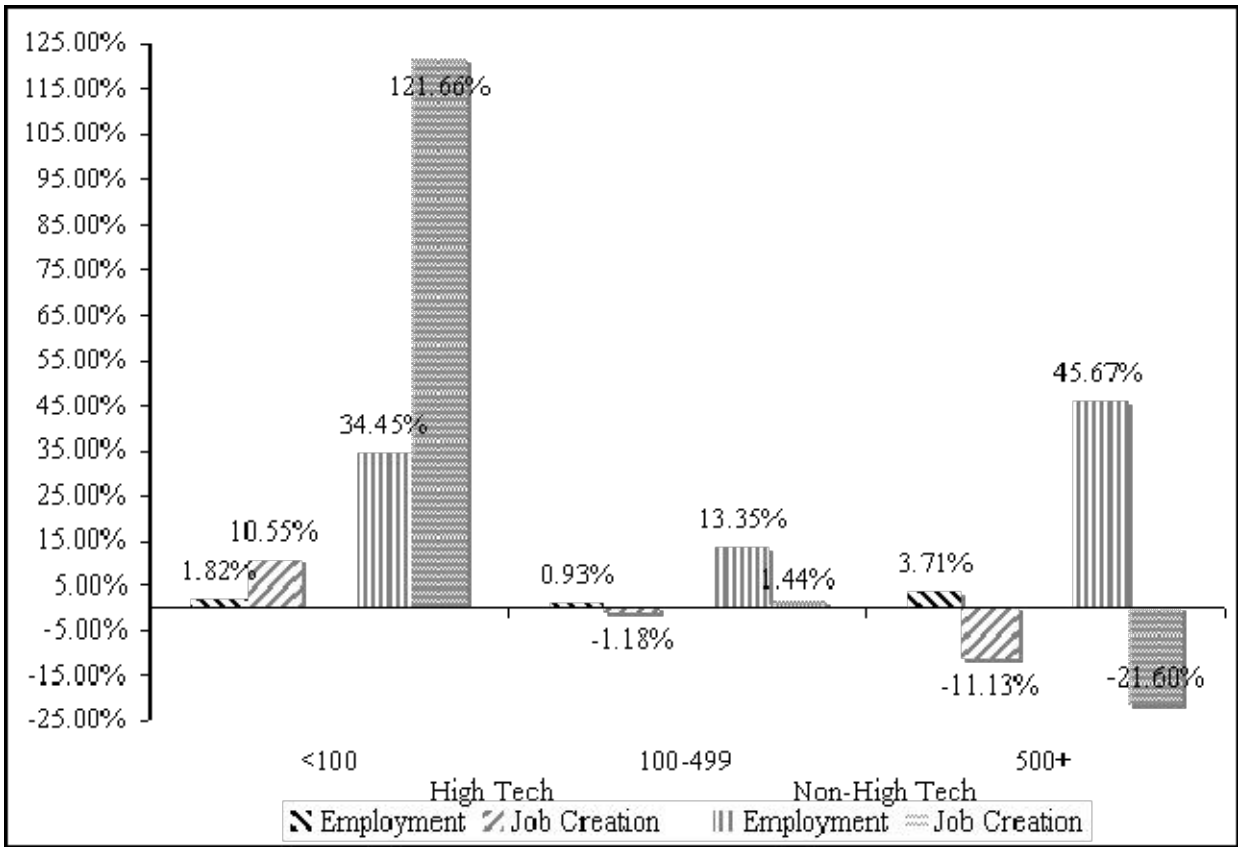


Table 6: Employment Growth by Year

	<100	100-499	>500
High Tech 1998	8.91%	1.60%	-0.11%
High Tech 1999	11.42%	4.43%	-2.85%
High Tech 2000	10.02%	4.81%	1.81%
High Tech 2001	-4.03%	-10.85%	-10.49%
High Tech 2002	1.60%	-4.72%	-1.93%
Non-High Tech 1998	3.60%	1.09%	1.68%
Non-High Tech 1999	4.75%	1.27%	-1.53%
Non-High Tech 2000	4.74%	2.46%	1.62%
Non-High Tech 2001	2.41%	-0.40%	-0.51%
Non-High Tech 2002	0.95%	-3.74%	-3.22%
Total 1998	3.86%	1.13%	1.54%
Total 1999	5.08%	2.64%	1.50%
Total 2000	2.80%	-0.03%	-0.26%
Total 2001	0.68%	-4.15%	-3.89%
Total 2002	4.58%	0.72%	-1.72%

Although the results for this time period are strong, the limited time frame of the data does pose some concern as to whether these results will hold over time. Kirchhoff (1994) showed similar effects for 1976-1984, and as the Census Bureau completes tabulation of subsequent years, we expect that analysis of the new data will support the results found here.

DISCUSSION

The data are unequivocal: for this time period, at least, small high tech firms had a disproportionate positive impact on economic growth, as reflected by job creation. Larger high tech firms, on the other hand, had negative impacts on the job creation numbers. Non-high tech firms showed similar, but smaller impacts, though their overall impact was much larger due to the large base of non-high tech firms. There is strong support for Schumpeter's argument for the importance of the entrepreneur (Schumpeter, 1942), as well as evidence to that creative destruction is actually occurring in the economy. There is further support for the contention that creative destruction plays a bigger role in high tech industries than in non-high tech industries (Spencer & Kirchhoff, 2006).

We argue, therefore, that high tech entrepreneurship is a unique phenomenon that needs to be researched, distinct from other forms of entrepreneurship. There has been a trend in entrepreneurship research to conflate entrepreneurship with innovation (e.g., Shane & Venkataraman, 2000). We have shown here that high tech small firms hugely outperform high tech large firms. Thus, while some may "assert that entrepreneurship occurs irrespective of the size of organizations" (Wennekers & Thurik, 1999), the sharp distinctions between the impacts of large and small firms clearly demonstrate that new technology –based ventures are different not just in their size, but in their economic impact and deserve to be studied as a distinct phenomenon. And, given this employment growth evidence, new high tech firms are likely to be more innovative, both invention and commercialization, than large high tech firms.

The impacts on innovation and job creation clearly demonstrate that the new technology-based firm is an important phenomenon. The work presented here should be further analyzed as data for a long time period becomes available and a closer analysis of the reasons for the differences should be a focus.

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