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**What's New About the New Economy?
An Explanation of Firm Size,
Growth, and Liquidity**

Julie Ann Elston

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Dr. Julie Ann Elston, Department of Economics, University of Central Florida, Orlando,
FL 32816-1400, U.S.A. Tel. (407) 823-2078 Fax. (407) 823-3269
Email: Julie.Elston@bus.ucf.edu Website: <http://www.bus.ucf.edu/elston/>

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ABSTRACT

With the increasing competitive importance of scientific innovations associated with the New Economy firms, it has become critical to understand the dynamics of firm growth. This preliminary study analyzes the relationship between firm size and growth for 341 *Neuer Markt* firms from 1996-2000. By partitioning the size effect into financial and non-financial factors, it appears that it is not initial firm size *per se* that is linked to growth, but more importantly, the greater financial resources that large firms have that lead to higher growth. Once firm liquidity is controlled for, smaller New Economy firms grow more quickly—and that is new for Germany, where larger R&D intensive firms have dominated in the transmission of innovative technologies to the marketplace. Further, there is evidence that smaller firms are more liquidity constrained than the larger ones in the sample.

Efforts to promote the growth of innovative firms and technologies would do well to focus governmental policies and resources to smaller New Economy firms, including furthering efforts to strengthen the smaller firm's access to equity markets.

I. INTRODUCTION

The Link Between New Economy Growth and the *Neuer Markt*

The growth of the New Economy has become an increasingly important concern not only because of the scientific innovation associated with New Economy Firms (NEFs) and industries, but also because of their role as a source of employment. By empirically examining how the size-growth relationships work within the context of Germany, focusing on the *Neuer Markt* (NM) firms, this study hopes to improve our understanding of the New Economy and shed light on strategic directions for economic policies aimed at optimal growth.

Since there is no generally agreed upon definition of the NM, let us begin by characterizing NEFs as those whose primary line of business is the development or application of information or knowledge, in contrast to Old Economy Firms (OEFs), whose main line of business is the production of a physical asset or service.¹

It is a widely accepted stylized fact that much of the New Economy growth in the U.S. was funded from the equity markets via the NASDAQ. According to Rosen (2000), Germany's introduction of the NM in 1997 was an attempt to provide equity support to fuel Germany's smaller New Economy Firms. The importance of examining the link between equity markets and New Economy growth has not gone unnoticed by policy makers and scholars alike. There are in fact a number of interesting implications of this link that might shed some light on the process of financing innovation.

This research will address these issues by testing two refutable hypotheses regarding the growth behavior of the NEFs: 1) NEFs are smaller and grow more quickly than old economy (high-technology) firms; and 2) the relationship between firm size and growth is independent of firm liquidity constraints.

Growth Theory and Gibrat's Law

Gibrat's Law provides a well-established framework for examining the size-growth relationship in firms. Interest in establishing or refuting the empirical validity of the **Law of Proportional Effect**, or what has become known as **Gibrat's Law**, has exploded in recent years. In his comprehensive survey on "Gibrat's Legacy," Sutton (1997) interprets the Law as an "expected value of the increment firm's size in each period is proportional to the current size of the firm." Or as Mansfield (1962) articulated, "the probability of a given proportionate change in size during a specified period is the same for all firms regardless of their size at the beginning of the period."²

Earlier studies (Evans, 1987; Hall, 1987) suggest that Gibrat's Law does not always hold, and present some evidence of a negative relationship between firm size and growth for U.S. firms. Plausible reasons for these findings are that they included only large

¹ These definitions of NEF and OEF roughly follow those of Larry Summers, former Secretary of the Treasury of the US. Audretsch (2001) also provides a useful definition of the New Economy as one with four central characteristics: 1) globalization, 2) the shift to knowledge and ideas as a source of competitive advantage, 3) the increased importance of regional agglomerations and clusters, and 4) the emergence of entrepreneurship as an engine of growth and development.

² For other excellent survey articles on growth see: Wagner 1992, Geroski 1995, Schmidt 1995, Klomp 1996, and Caves 1998.

American firms, which are very large indeed. Recent studies that have concluded that initial firm size does impact firm growth include Wagner (1992), Reid (1995), Harhoff, Stahl, and Woywode (1998), Weiss (1998), Audretsch (1995), Audretsch et al. (1999), and Almus and Nerlinger (2000). More recently, Audretsch and Elston (AE)(2001) suggest that rather than just asking whether Gibrat's law holds or not, one should ask under which context it may hold.³ That is to say, they find that the results for Gibrat's Law in Germany are highly sensitive to the time frame examined, industry, and model specification.

This paper will build on this approach by examining the circumstances under which initial size may effect growth in Germany's New Economy sector, that is controlling for industry, age, accounting year, and liquidity constraints of the firm for various firm groupings. The second section of the paper will discuss the empirical growth model. The data and measurement issues are explained in the third section. In the fourth section, the empirical results are presented and discussed. Finally, in the fifth section a summary and conclusions are provided.

II. EMPIRICAL GROWTH MODEL

In his survey article on growth, Sutton (1997) suggests that while the number of employees at a firm is often used to measure growth, there are other less explored alternative measures that also warrant consideration, such as the growth of firm sales or physical assets. Hall (1987), for example, found that using either the growth of physical assets or the number of employees yielded equivalent measures of growth. In this study I propose that, while these definitions may be true equivalents for OEFs, the more appropriate growth measure for NEFs should be based on the number employees due to the relative scarcity of tangible or physical assets of New Economy firms.⁴

Formalizing the relationship between size and growth, Gibrat's law implies that the present size of firm i in period t may be decomposed into the product of a "proportional effect" and the initial firm size as:

$$\text{Size}_{i,t} = (1 + \varepsilon_t) \text{Size}_{i,t-1}$$

where $(1 + \varepsilon_t)$ denotes the proportional effect for firm i in period t . Here, the random shock ε_t is assumed to be identically and independently distributed. Taking the natural log and using the fact that for small ε , $\ln(1 + \varepsilon) \approx \varepsilon$, we derive the following relationship,

$$\ln(\text{Size}_{i,t}) = \ln(\text{Size}_{i,0}) + \sum_{k=1}^t \varepsilon_{ik}$$

which as $t \rightarrow \infty$ results is a distribution which is approximately log normal with properties that $\ln(\text{Size}_{i,t}) \sim N(t\mu_\varepsilon, t\sigma_\varepsilon^2)$.⁵

⁴ Hall, Bronwyn (1987) "The Relationship Between Firm Size and Firm Growth in the U.S. Manufacturing Sector" *International Journal of Industrial Organization*, vol. 35, no. 4, pp 583-604; and Sutton, John (1997) "Gibrat's Legacy," *Journal of Economic Literature*, Vol. XXXV, pp. 40-59.

⁵ Almus and Nerlinger (2000) confirm this distributional assumption via kernel density estimates for German firms 1990-1996.

The annual percentage firm growth then can be measured using number of employees (Growth1_{it}), or alternatively, net tax sales (Growth2_{it}) of the firm as:

$$\text{Growth}_{it} = \ln(S_{i,t}) - \ln(S_{i,t-1}) / \ln(S_{i,t-1})$$

where growth is calculated as the difference in the log of size for firm i between this period t and the initial period ($t - 1$) size, over log of the initial period size.

Based on Hall (1987) or Evans (1987) the traditional empirical growth equation for testing the hypothesis that initial firm size impacts firm growth can be specified:

$$\text{Growth}_{i,t} = \mathbf{B}_1 \ln(\text{Size}_{i,t-1}) + \mathbf{B}_2 \ln(\text{Size}_{i,t-1})^2 + \mathbf{B}_3 \text{Age}_{i,t-1} + \varepsilon_i \quad (1)$$

where growth for firm i in period t is a function of initial firm size, size^2 , age—which is measured by the life span of the firm, and ε a stochastic error term.

An alternative model that controls other factors related to growth including firm liquidity, variations in accounting year reporting, and industry effects can be specified as:

$$\text{Growth}_{i,t} = \mathbf{B}_1 \ln(\text{Size}_{i,t-1}) + \mathbf{B}_2 \ln(\text{Size}_{i,t-1})^2 + \mathbf{B}_3 \text{Age}_{i,t-1} + \mathbf{B}_4 \text{CF}_{i,t-1} + \mathbf{B}_5 \mathbf{D}_{\text{acctg}} + \mathbf{B}_6 \mathbf{D}_{\text{ind}} + \varepsilon_i \quad (2)$$

where growth for firm i in period t is a function of initial firm size, size^2 , age—which is measured by the life span of the firm, CF, or cash flow, represent the proxy for the liquidity constraints of the firm, and ε a stochastic error term. We can also control for industry effects by using a vector of industry dummies \mathbf{D}_{ind} , and a vector of dummies that controls for both macro shocks and accounting year differences in annual reports $\mathbf{D}_{\text{acctg}}$.

Dummy variables for accounting year schemes were constructed because some firms reported annual figures for January-December accounting years while seventy other firms had “other” accounting years including July-June. For firms with an end of calendar year accounting scheme, one set of time dummies was created for each year, and another set of time dummies were created for each year for firms with other accounting schemes. Regressions were run without an intercept term to account for the inclusion of these mutually exclusive dummies in the model.

Liquidity Constraints

Firm revenues are used as a proxy of liquidity constraints of the firm in much the same way that they are introduced on the right-hand-side of the empirical investment models in the literature.⁶ The reasoning is that once we move away from the perfect capital markets world, we find that financial and real decisions are not always separable for the firm. Liquidity problems, often exacerbated by asymmetry of information between suppliers of finance and firms, for example, will influence real firm decisions such as investment in capital or labor—and then, by definition, firm growth as measured by such. This research blends two strands of the economic literature, that of the growth literature and that of the investment-liquidity literature. In the investment-liquidity literature, the impact of liquidity constraints on investment, or essentially capital stock

⁶ For a detailed description of the theoretical and empirical underpinnings of the liquidity constrained investment models see for example, Hoshi, Kashyap, and Scharfstein, (1991), Elston (1993), Bond and Meghir (1994) or Fazzari, Hubbard and Peterson (1988).

growth, is examined, while I propose analyzing the impact of liquidity constraints on employment growth.

The purpose of including a measure of firm liquidity into the regression is two-fold. First, by adding this measure, we are able to examine the degree to which liquidity constraints impact a firm's growth. A second interpretation, however, is that by holding liquidity constraints constant, we can focus on the relationship of interest—that of firm size to growth. In other words, by controlling for the liquidity constraints of the firm we are able to separate out the size effects into two pieces, those that stem from “financial” size effects and those from “other” size effects. This will allow us to distinguish whether firm size may promote growth simply because larger firms have better access to capital or larger cash reserves, or 2) whether other size effects related to firm economies of scale and scope, life-cycle, or other possible related factors of importance.

To further sharpen the focus on firm liquidity, we can also examine firm groupings based on whether the firm is part of a consolidated group or not. Since we might expect that the ninety-three consolidated firms may have better access to capital (from the mother company for example) than unconsolidated firms, we can examine growth behavior between consolidated and unconsolidated firm groups. Heteroscedastic consistent parameter estimates were obtained using White's (1980) approach, and are reported in Section IV, Empirical Results.

To test for the importance of the alternative growth measures based on employees versus revenues, growth equations were run on an all firm sample, as well as various subgroups of firms including size groupings, and groupings by consolidation status.⁷

Another way that the New Economy is purported to be different is the time a firm takes from incorporation to attaining IPO status. Jovanovic and Rousseau (JR)(2001) show that young firms entering the NYSE, AMEX, and the NASDAQ today are as young as the companies that entered at the close of the nineteenth century. They reason that the electricity-era and the information-era have much in common—as firms enter the market younger because the technologies they bring are too productive not to be put on the market. NM firms took an average of 2.2 years to IPO from date of incorporation. However, the sample is highly skewed, with about 80 percent of the firms under two years of age, 10 percent being older than 10 years, and 10 percent somewhere in between.^{8,9} Furthermore, since the NM was not formally introduced until March 1997, there is a bias towards younger firms in the sample. In any event, since 1998 the NM firms are relatively young, which is broadly consistent with the notion that the firms on the NM may have IPO-ed quickly because the technologies they bring are too productive to be kept out of the market place.

⁷ Because I had relatively few observations due to the thin time series nature of the data and the small size of the NM I was unable to obtain robust results for growth estimates by industry. Instead I report means by industry and create ten industry dummies to control for industry effects in the final estimates.

⁸ According to Martin 2001, the average age of NM firms in 1998 was nineteen years, whereas after then the average age of firms plummeted. Between 1910-1980 most firms in the Jovanovic and Rousseau U.S. sample took between from ten-sixty years to IPO.

⁹ It is possible that some of these firms are also listed on other stock exchanges.

III. THE NM, THE DATA AND MEASUREMENT ISSUES

The Neuer Markt

The NM was introduced by the *Deutsche Börse* on March 10, 1997 and quickly grew from two to 343 firms. Unfortunately, since about mid-2000 market forces have steadily inched downward, leaving the current (July 2001) index at nearly the opening value of 1000 points—far from the maximum value of 8559.32 points reached on March 10, 2000.¹⁰ The reasons for the bursting of this bubble are beyond the scope of this paper, but much controversy has arisen over the need for a stronger regulatory environment to clarify the value and risk of NM firms and to protect shareholders. The German Parliament is expected to pass a series of laws aimed at modernizing the framework of the financial markets before the 2002 national elections.¹¹

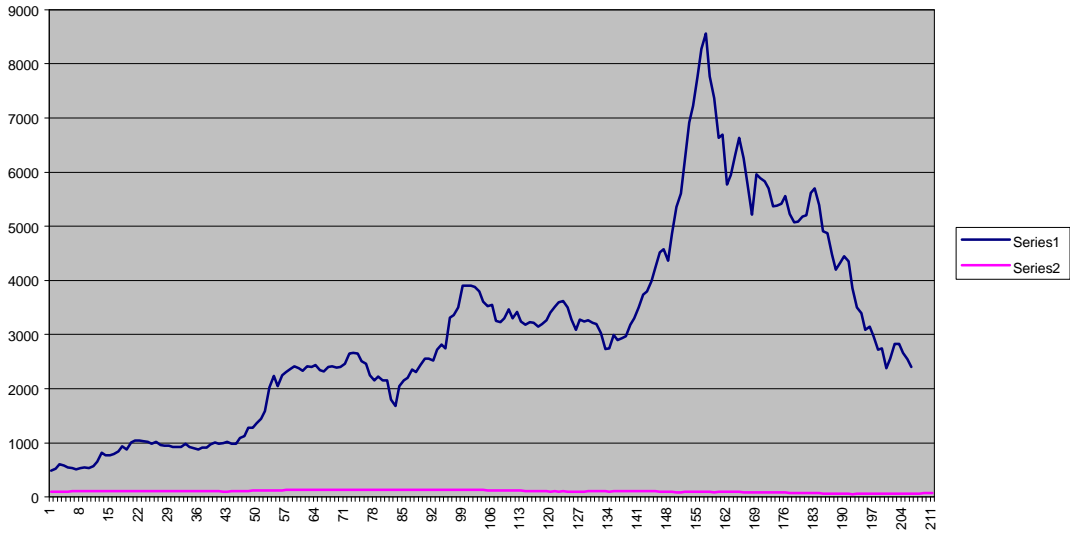
Admission and reporting requirements for NM listed firms are more stringent than the rules for the first (*Amtlicher Handel*) and second (*Geregelter Markt*) segments of the Frankfurt exchange. Firms generally use the International Accounting Standards (IAS) or the U.S.-GAAP reporting standards, but some have made use of a short-term exemption period during which they may follow reporting requirements from the HGB or German Commercial Code. While the rules of the NM are more stringent than those of most exchanges in Europe, they remain more relaxed and less frequently enforced by the *Bundesaufsichtsamt für den Wertpapierhandel* (BAWe) than their SEC equivalents.¹²

¹⁰ During from March 2000 to July 2001 the market capitalization went from 234€ to 58€.

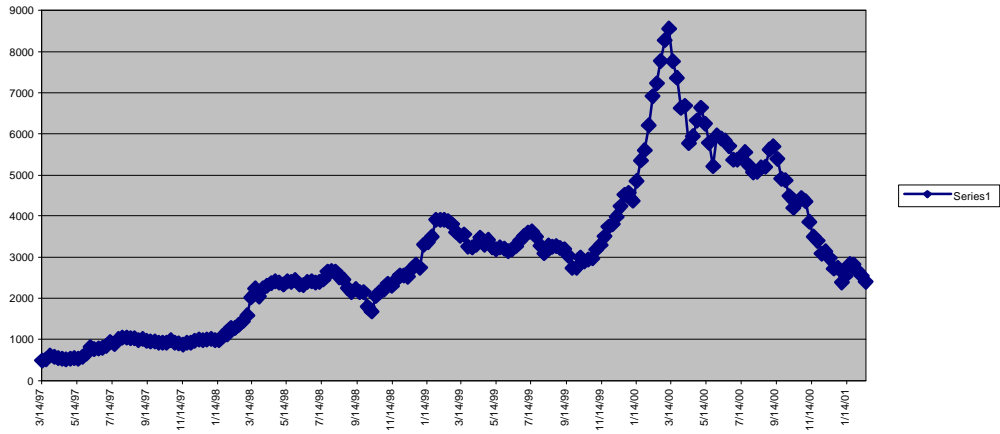
¹¹ As of July 2001 discussions are underway for enacting de-listing rules for the NM “penny” stocks currently trading under 1€ which comprise nearly 10 percent of the NM firms.

¹² For example, in the first six months of 2000, the BAWe fined forty-four companies for breaching rules and handed 9 suspected cases of insider trading to state prosecutors. Further responses such as changing the maximum penalty from \$9,000 to \$90,000 is still considered inadequate by many involved. There is likely to be a lot more activity over the next two years in terms of reworking the regulatory framework of the NM in Germany, with current discussions underway regarding rules for de-listing poor performers.

NM & NASDAQ First 3 Years



NEMAX First 3 Years



NASDAQ First 3 Years

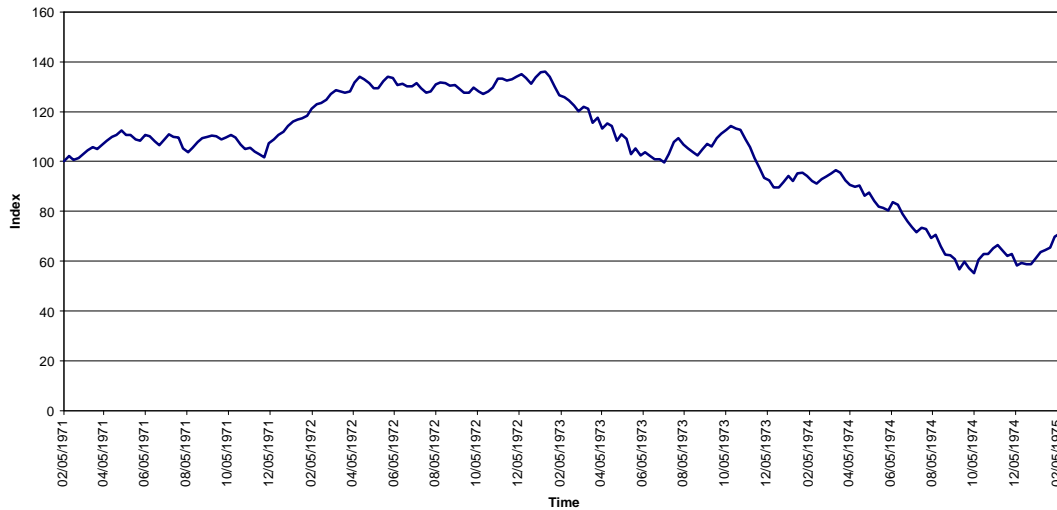


Figure 1 plots the NEMAX and the NASDAQ indices over the first three years of their respective lives—the NASDAQ line is just above and parallel to the horizontal axis. When the NEMAX and NASDAQ are plotted separately in Figures 2 and 3, we see more clearly that the NASDAQ actually ended in an index value well below the opening index level at the end of the first three years of life—not much different than what we are seeing with the NM—but with much less volatility in the index than the NEMAX.

The Data

The firm level data for the NEFs came from the Hoppenstedt database, the *Deutsche Bundesbank*, and publicly available data from the web, which in total comprise 411 observations. In Appendix A Table A1, I have listed, as of June 2001, the 341 NM firms used, as well as their IPO dates and their industry groupings. The exact number of firms used in calculating summary statistics and regressions varied somewhat based on data availability for variables used in that year. Forty-five of the firms, or over 13 percent, are not German, but are firms that originate from Austria, Britain, France, Israel, Ireland, Luxembourg, the Netherlands, Switzerland, and the U.S.

The firm level data for the OEF were taken from the Bonn Database. The sample has 295 German firms from the sample period 1970-1984. The Bonn Database was constructed from the annual business reports of firms, the *Handbuch Der Aktiengesellschaften*, and the *Statistisches Jahrbuch*. See Chirinko and Elston (1996) for further details on the database.

Common proxies of firm liquidity constraints in the investment-liquidity literature include either sales revenue, cash flow, or profits of the firm. This study uses net tax sales revenue as reported under the HGB accounting rules as a proxy for the measure of cash flow or firm liquidity constraints. Previous studies on investment-liquidity studies, including Bond et al. (1997) have found this to be an adequate proxy for measuring OEF liquidity constraints in Germany.

All firms in this study are listed firms because a) the NM is a major focus of this study and b) data availability for OEFs is best for the listed firms. However, there are indeed other non-listed privately funded NEFs and OEFs in Germany, which are unfortunately beyond the scope of this study due to a lack of publicly available data.

Measurement Issues

Sample selection issues can be a problem if the data sample consists only of the firm survivors. An examination of the data sample revealed that up until May 2001 there were no firm deaths, and therefore there should be no bias in estimates due to the entry and exit of firms during this sample period.¹³

For measuring growth based on firm sales, I use net tax sales revenue reported by firms using the HGB accounting standard in thousands of DM when data was reported in Euro it was converted to DM using the fixed exchange rate of 1.96.

Firm Age and Time to IPO

Time to IPO was calculated for all firms in the sample to examine the importance of age in IPO cohort year. The oldest firm in the study, PSIAG Gesellschaft incorporated in 1979, while the youngest firms in the study are less than one year old. Two hundred and eighty-one firms were less than two years old, while firms two years old or older totaled sixty. Interestingly, firm age tended to be statistically significant in the growth equations only when we did not control for liquidity effects, and suggest that for R&D intensive OEFs older firms grew more quickly. Unreported correlation estimates of founding year of firm and time to IPO reveal a high ($R^2=.9866$) and negative correlation, indicating that the younger firm's time to IPO is shorter. This negative correlation can be explained by the fact that the age of the NM itself is a relatively small percentage of these firm life spans, but this finding is also broadly consistent with the notion that the information technology-era firms are brought to market earlier.

To be consistent with the empirical literature on size effects, Large Firms are defined as those with more than 500 employees and Small Firms are those with 500 or fewer employees. Service firms include all twenty-eight firms in the sample listed as Financial or Commercial Services Firms—all other firms are treated as Manufacturing.

Finally, since the data, due to their infant nature, have a relatively thin time dimension, Table A1 in Appendix A reports firm size and growth means both by IPO cohort group as well as industry groups. Descriptive statistics in Table A4 also reveal that most firms in our sample IPO-ed in 1999 (213 firms) and that firm growth averaged almost 10 percent over the sample period, during which small firms grew on average more than twice as quickly as large firms.

Table A2 reports summary statistics for firms by industry group. From an examination of these annualized—percentage means it is apparent that industry growth rates and sizes vary widely. For example, in terms of employees, Biotechnology (169), Internet (236), and Media and Advertising (146) appear to be relatively smaller firms—an order of magnitude smaller than Financial (1155) and Commercial Services (1109) firms.

¹³ According to the *Süddeutsche Zeitung* Nr. 153, page 23, July 6, 2001 there have been six firm insolvencies after May 2000, including: Gigabell, Infomatic, Kabel New Media, Metabox, Micrologica, Refugium, Sunburst, and Teldafax.

While, not surprisingly, Internet firms appear to have grown much more quickly, at 28 percent, than any other industry during the 1998-2000 time period, with Biotechnology a distant second at 17 percent growth.

IV. EMPIRICAL RESULTS

Table 1. Industry Fixed-Effects NM Firm Growth 1997 - 2000

Growth Measures	Size	Size²	CF	adj R²	F	N
Growth1	0.0119 (-0.55)	-0.0055* (-2.22)	---	0.6368	23.48 -0.0001	306
Growth1	-0.1489* (-3.36)	0.0113* -2.45	-0.0024 (-0.59)	0.7758	18.34 (0.001)	126
Growth2	-0.0454* (-4.8)	0.0016** (1.81)	---	0.3833	2.04 (0.0212)	77

Note size = number of ln (employees) in all regressions except for the Growth2 equation where size= ln (sales).

Numbers in parenthesis are t-values, *=5% and **=10% statistical significance.

All regressions use annual/accounting dummies and industry dummies.

Growth 1 is annual percentage change in employees average over sample period.

Growth 2 is annual percentage change in sales average over sample period.

Table 2. Industry Fixed Effects NM Firm Growth 1997-2000

Industry Groups	Size	Size²	CF	adj R²	F	N
Consolidated	1.391 (1.02)	-0.1172 (-1.00)	0.0144* (2.50)	0.9594	2.78 (0.297)	19
Unconsolidated	-0.2340* (-4.87)	0.0172* -3.6	0.0145** (1.92)	0.6971	10.29 (0.0001)	93
Small						
a.	0.1733* (7.64)	-0.0340* (-8.82)	--- ---	0.4484	21.75 (0.0001)	244
b.	-0.3402* (-3.74)	0.0320* (2.76)	0.0124** (1.65)	0.7063	10.95 (0.0001)	100
Large						
a.	0.1048* (6.81)	-0.0139* (-6.4)	--- ---	0.7468	10.31 (0.0001)	49
b.	0.1459 (0.76)	-0.0179 (-1.31)	0.0073 (1.33)	0.8691	8.71 (0.0001)	37
Service	0.0521* (2.41)	-0.0062* (-1.98)	--- ---	.7429	9.71 (0.0001)	23
Manufacturing	0.1022* (5.41)	-0.1835* (-6.49)	--- ---	.3657	29.78 (0.0001)	262

Numbers in parenthesis are t-values, *=5% and **=10% statistical significance.

All regressions use annual/accounting dummies and industry dummies.

Growth 1 is annual percentage change in employees average in sample period.

Growth 2 is annual percentage change in sales in sample period.

Table 3. Old vs New Economy Firm Growth in Germany

	Old Economy						New Economy	
	A		B		C		D	
	All Firms 1970-1984		Low R&D Intensity		High R&D Intensity		All Firms 1997-2000	
Size	0.0782*	0.1016*	0.0937*	0.1312*	0.0236**	0.2857	0.0173	-0.1583*
	(2.7)	(2.73)	(2.97)	(3.48)	(1.72)	(1.62)	(0.82)	(-3.36)
Size ²	-0.004*	-0.0063*	-.0059*	-0.0094*	-0.0113**	-0.0170	-.0067*	0.0157*
	(-2.31)	(-2.33)	(-2.62)	(-3.17)	(-1.65)	(-1.51)	(-2.67)	(2.44)
Age	0.0003	0.0002	-.0262	-0.0258	0.1578*	0.1627*	0.0146*	0.0053
	(0.02)	(0.01)	(-1.61)	(-1.60)	(2.56)	(2.60)	(2.39)	(0.75)
CF	---	0.000	---	0.00005**	---	0.00002	---	-0.0037
	---	(1.00)	---	(1.79)	---	(0.63)	---	(-0.76)
Adj. R ²	0.1912	0.1950	0.2874	.3019	0.2072	0.2139	0.6432	0.7758
F	4.22	3.97	5.24	5.16	1.25	1.16	24.94	18.34
(prob.)	(0.0001)	(0.0001)	(0.0001)	(0.0001)	(0.2827)	(0.0034)	(0.0001)	(0.0001)
N	226	226	168	168	58	58	297	126

Growth is measured as annual percentage change in employment. Old Economy estimates from 300 firm sample 1970-1984.

New Economy estimates from 1997-2000 for 300 firm sample. All regressions use industry and beginning year time dummies.

Numbers in parenthesis are t-values, *=5% and **=10% statistical significance.

Results for industry-fixed-effects regressions of growth on firm size are reported in Table 1.¹⁴ Regressions run for alternate growth measures based on 1) employee growth and 2) revenue growth show consistency that Gibrat's law does not hold for this data unless we control for firm liquidity.¹⁵ Consistent findings across both Growth1 and Growth2 measures indicate that if we control for liquidity constraints, although do not appear significant, smaller firms grow more quickly than larger ones firms on the NM.

In Table 2 we examine more closely the importance of firm size by dividing up the data into two groups of firms, those with 500 or fewer employees or small firms and those with more than 500 employees or large firms. Without controlling for liquidity

¹⁴ Because unreported industry effects were consistently significant in these regressions, and because industrial policy suggests that industry effects are important, regressions were also done on industrial groups of service and manufacturing firms.

¹⁵ Liquidity constraints cannot be used in the Growth2 equation as it is perfectly correlated with the dependent variable.

constraints, larger firms grow faster in both the small and large firm groups. However, if we control for firm liquidity, smaller firms in the small group grow faster and size no longer impacts firm growth for large firms.

Comparing coefficients across equations estimated for small and large firm groups, growth appears to be more liquidity constrained for small firms than for large firms in the study based on both the size and statistical significance of the CF or liquidity coefficient. Put another way, this may be viewed as evidence that to some degree larger firms grow more quickly because of fewer problems with binding liquidity constraints. However, the largest of the large firms do not grow more quickly if we control for firm liquidity. I conclude that by partitioning the size effect into financial and non-financial components, we find that the financial effect has a significant impact on firm growth. That is, for the smallest NM firms, access to capital that comes with increasing firm size may be a more significant factor of growth than other non-financial growth factors related to size (e.g. life-cycle effects and economies of scale and scope).

It is interesting to note that smaller firms grow more quickly for the unconsolidated firm group, but not for the consolidated firm group when we control for liquidity constraints. Since both groups have significant liquidity constraints as measured by the size and statistical significance of the CF variable, I interpret this as evidence that consolidated firms may still have financial constraints in spite of the fact that they may have access to capital from the mother organization.

Table 3 compares the regression results for both the NEF and OEFs represented by a panel of 300 mostly large German firms from 1970-1986.¹⁶

What's New About the New Economy?

Comparing these results with a sample of 300 German stock-held, and mostly manufacturing firms from 1970-1986, we find several differences between the new and old economy firms.¹⁷ In Table 3 column A we also control for firm Age, and find that larger firms in the Old Economy grew faster and that liquidity constraints do not appear to be particularly binding—a finding consistent with earlier studies on this time period in Germany including Audretsch and Elston (2001). When we divide these firms into two groups based on high and low R&D intensity, represented by columns B and C, we find that Gibrat's Law fails especially for low R&D firms in that larger firms grow faster.

Column D estimates for the New Economy show, consistent with results in Tables 1 and 2, that if we control for firm liquidity that only then do we see that smaller firms grow faster in the New Economy. Comparing these results with those for the Old Economy where larger firms grew faster we find a shift in the size-growth relation between Old and New Economies. Alternatively, if we compare results for the high R&D firms—firms that presumably are more similar to New Economy firms, we still find evidence consistent with the notion that what's new about the new economy is that smaller firms grow faster—quite different from the Old Economy, where the larger firms grew more quickly whether we controlled for liquidity or not.

¹⁶ For details see results for the OEFs from Audretsch and Elston (2001).

¹⁷ Problems of comparing the New and Old Economy firm results directly are admittedly problematic. To aid the reader in this process however, Old Economy firms have additionally been divided into high and low R&D intensity to improve this process.

These results are new and important to the growth literature because they suggest that controlling for the impact of firm liquidity constraints makes a significant difference in how we are able to measure and interpret the size growth relation.

Focusing on policy implications, if we believe that NM firms embody new information technologies—not a far fetched notion—then this may signal a) a fundamental shift not only in the transmission mechanism of innovation, but also in b) the size-growth relationship in Germany. That is to say, according to stylized facts as set out in AE and Audretsch and Weigand (1999), prior to the 1990s much of the innovation in Germany took place in larger firms. Whereas what this study suggests is that today, with the advent of the NM, we see smaller information technology firms (mean size 195 employees) growing rapidly and quickly bringing their technologies to market.

If policymakers viewed the introduction of the NM as a capital market experiment to channel resources into growing smaller innovative firms with rapid market entries, then the results of this study would suggest a partial victory in that NM firms may not face significant liquidity constraints in general. However, when we partition the data by size we see that the smallest firms are experiencing binding constraints.¹⁸

The second issue that this study addresses is the degree to which liquidity constraints may be linked to firm growth. The evidence suggests that firm growth is more sensitive to liquidity constraints for the smaller firms in the study. This indicates that being on the NM may not be enough to attenuate the problems of capital access for these firms.¹⁹

V. SUMMARY AND CONCLUSIONS

These findings are broadly consistent with earlier studies on Old Economy firms that show there does in fact seem to be a proportional relationship between firm size and growth, but only under certain circumstances. In this context I compare German firm growth controlling for liquidity, and find that the smaller firms grow more quickly than the larger ones. Further, I find that by partitioning the size effect into financial and non-financial factors it becomes clear that it is not initial firm size *per se* that is linked to growth, but more importantly perhaps, the greater financial resources that large firms have which lead to higher growth. Once firm liquidity is controlled for, smaller New Economy firms grow more quickly—and that is new for Germany.

This study also suggests the possibility that sometime in the 1990s, Germany's economic landscape may have changed to one in which rapidly growing smaller technology firms became the likely transmitters of innovation to the marketplace stepping up to the role, at least to some degree, that larger R&D intensive firms formerly played in the transmission of innovative technology.²⁰

¹⁹ Although there remains the possibility of a negative self-selection of cash poor firms seeking to be listed on the NM as a means of alleviating liquidity problems, and the results do not control for the possibility that high growth liquidity constrained firms may have self-selected into the NM, therefore the sample results may not be fully representative of the New Economy firms as a population.

²⁰ Future studies on the hazard and survival rates of NM firms might be able to further clarify issues as on how firm liquidity may effect firm growth and survival.

There are several policy implications of this study. In terms of promoting economic development, if smaller firms in Germany are becoming more important in their role as transmitters of innovation, then governmental policies and resources need to be directed to them in order to insure future growth and innovation. Such policies would also be broadly consistent with those aimed at increasing the number of small New Economy firms as a means of increasing employment.

This study also suggests that smallest of the New Economy firms may yet be experiencing liquidity constrained growth, and that policies aimed at improving their access to capital, including equity markets, may be an effective means of promoting innovative firm growth.

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Appendix B

List of Neuer Markt Firms as of May 2001

Firm name	IPO date	Index	Industry group	Industry subgroup
3UTELEKOMMUNIKATIONAG	25.11.1999	10	Telecommunications	Telecommunications
4MBOINTERNATLELECTRONICAG	28.8.2000	9	Electronics	Distribution/Wholesale
AAPIMPLANTATE	10.5.1999	7	Healthcare	Healthcare-Products
ABITAG	3.2.2000	4	Internet	Software
ACGAG	1.7.1999	9	Electronics	Electronics
ACSERVICEAG	30.11.1998	5	Software	Software
ADCONTELEMETRYAG	28.7.1999	9	Electronics	Electronics
ADLINKIN	.	4	Internet	.
ADORIAG	10.5.2000	4	Internet	Internet
ADPEPPERMEDIANV	9.10.2000	4	Internet	Internet
ADPHOSADVANCEDPHOTONICS	31.7.2000	9	Electronics	Machinery-Diversified
ADSSYSTEMSAG	17.11.1999	9	Electronics	Telecommunications
ADVAAGOPTICALNETWORKING	29.3.1999	9	Electronics	Telecommunications
ADVANCED	.	6	Media and Advertising	.
ADVANCED	.	9	Electronics	.
AECON.V.	25.7.2000	9	Electronics	Electronics
AIXTRON	6.11.1997	9	Electronics	Semiconductors
ALLGEIERCOMPUTERAG	11.7.2000	5	Software	Software
ALPHAFORMAG	28.6.2000	3	Commercial Services	Commercial Services
AMATECHAG	13.6.2000	9	Electronics	Electronics
ANALYTIKJENAAG	3.7.2000	9	Electronics	Biotechnology
ANTWERPESAG	17.4.2000	4	Internet	Internet
ARBOMEDIA.NETAG	9.5.2000	6	Media and Advertising	Advertising
ARTICON-INTEGRALISAG	28.10.1998	9	Electronics	Computers
ARTNET.COMAG	17.5.1999	4	Internet	Internet
ARTSTORAG	11.7.2000	5	Software	Computers
ARXESINFORMATIONDESIGNAG	25.1.1999	5	Software	Computers
ASCLEPION-MEDITECAG	22.3.2000	7	Healthcare	Healthcare-Products
ATOSSSOFTWAREAG	21.3.2000	8	Data Processing	Software
AUGUSTATECHNOLOGIEAG	5.5.1998	9	Electronics	Miscellaneous Manufactur
AUSTRIATECHNOLOGIE&SYSTEM	16.7.1999	9	Electronics	Electronics
B.I.S.BOERSENINFORMATIONDIE	14.6.1999	8	Data Processing	Media
BAEURERAG	2.12.1999	8	Data Processing	Software
BALDAAG	23.11.1999	9	Electronics	Miscellaneous Manufactur

BASLERAG	23.3.1999	9	Electronics	Machinery-Diversified
BBBIOTECHAG-GERMCTF	.	1	Biotechnology	Closed-end Funds
BBMEDTEC	.	7	Healthcare	.
BECHTLEAG	30.3.2000	5	Software	Retail
BEKOHOLDINGAG	14.6.1999	5	Software	Software
BERTRANDTAG	1.10.1996	3	Commercial Services	Commercial Services
BETASYSTEMSSOFTWAREAG	30.6.1997	8	Data Processing	Software
BINTECCOMMUNICATIONS	10.3.1999	10	Telecommunications	Telecommunications
BIODATAINFORMATIONTECHAG	22.2.2000	9	Electronics	Computers
BIOLITECAG	15.11.2000	7	Healthcare	Healthcare-Products
BIOTISSUETECHNOLOGIESAG	1.12.2000	1	Biotechnology	Biotechnology
BIPOP-CARIRESPA	.	2	Financial Ser	.
BKNINTERNATIONALAG	9.3.2000	6	Media and Advertising	Media
BLUECNEWWECONOMYCONSULT	24.8.2000	4	Internet	Internet
BOVAG	21.6.2000	5	Software	Software
BRAINFORCESOFTWAREAG	10.6.1999	5	Software	Software
BRAININTERNATIONAL	10.3.1999	8	Data Processing	Software
BRAINPOOLTVAG	23.11.1999	6	Media and Advertising	Media
BRAINPOWERNV	21.9.2000	8	Data Processing	Software
BROADVISIONINC	.	4	Internet	Internet
BROKATAG	17.9.1998	4	Internet	Internet
BUCH.DEINTERNETSTORESAG	8.11.1999	4	Internet	Internet
CAAAG	21.7.2000	8	Data Processing	Software
CAATOOSEEAG	20.9.2000	5	Software	Software
CAMELOTAG	30.10.2000	10	Telecommunications	Telecommunications
CANCOMITSYSTEMEAG	16.9.1999	5	Software	Computers
CARRIER1INTLSA	24.2.2000	10	Telecommunications	Telecommunications
CDVSOFTWAREENTERTAINMENT	17.4.2000	8	Data Processing	Software
CECOMPUTEREQUIPMENT	27.4.1998	8	Data Processing	Software
CECONSUMERELECTRONIC	31.12.1998	9	Electronics	Semiconductors
CENITAG	8.12.1998	5	Software	Software
CENTROTECAG	.	3	Commercial Services	Chemicals
CEOTRONICSAG	9.11.1998	9	Electronics	Telecommunications
CINEMEDIAFILMAG	3.2.1999	6	Media and Advertising	Retail
CO.DONAG	14.2.2001	1	Biotechnology	Biotechnology
COMDIRECTBANKAG	5.6.2000	2	Financial Ser	Internet
COMPUTECMEDIAAG	30.11.1998	6	Media and Advertising	Media
COMPUTERLINKSAG	7.7.1999	5	Software	Computers
COMROADAG	.	9	Electronics	Telecommunications

COMTRADEAG	24.11.2000	4	Internet	Computers
CONCEPT!AG	27.3.2000	4	Internet	Computers
CONDATAG	31.12.2000	10	Telecommunications	Software
CONDUITPLC-REGSGDR	30.6.2000	10	Telecommunications	Telecommunications
CONSORSDISCOUNT-BROKERAG	26.4.1999	2	Financial Ser	Diversified Finan Serv
CONSTANTINFILMAG	13.9.1999	6	Media and Advertising	Media
CORAGINSURANCETECHNOLOGIE	27.7.1998	8	Data Processing	Software
CPUSOFTWAREHOUSEAG	19.4.1999	8	Data Processing	Software
CTSEVENTIM	1.2.2000	6	Media and Advertising	Leisure Time
CURASANAG	20.7.2000	1	Biotechnology	Pharmaceuticals
CYBERNETINTERNETSVCSINTL	.	4	Internet	Internet
CYBIOAG	25.11.1999	1	Biotechnology	Healthcare-Products
CYCOSAG	18.4.2000	10	Telecommunications	Software
D.LOGISTICSAG	28.4.1999	3	Commercial Services	Transportation
D+SONLINEAG	23.5.2000	4	Internet	Internet
DASWERKAG	25.8.1999	6	Media and Advertising	Entertainment
DATADESIGNAG	9.11.1998	4	Internet	Internet
DATASAVEAGINFORMATIONSSYST	14.2.2000	5	Software	Internet
DCIDATABASEFORCOMMERCE	13.3.2000	4	Internet	Internet
DEAGDEUTSCHEENTERTAINMENT	14.9.1998	6	Media and Advertising	Leisure Time
DIALOGSEMICONDUCTORPLC	13.10.1999	9	Electronics	Semiconductors
DICOMGROUPLC-GERMCERT	28.1.2000	8	Data Processing	Software
DIGITALADVERTISINGAG	29.10.1999	4	Internet	Advertising
DINOENTERTAINMENT	12.10.1999	6	Media and Advertising	Media
DIREKTANLAGEBANKAG	15.11.1999	2	Financial Ser	Diversified Finan Serv
DRHOENLEAG	24.1.2001	9	Electronics	Electronics
DRILLISCHAG	22.4.1998	10	Telecommunications	Telecommunications
E.MULTIDIGITALEDIENSTEAG	19.7.2000	4	Internet	Internet
EASYSOFTWAREAG	19.4.1999	8	Data Processing	Software
EBOOKERS.COMPLC-SPONSADR	.	4	Internet	Internet
ECKERT&ZIEGLERSTRAHLENUN	25.5.1999	7	Healthcare	Healthcare-Products
EDELMUSICAG	2.9.1998	6	Media and Advertising	Home Furnishings
EJAYAG	8.8.2000	6	Media and Advertising	Software
ELECTRONICSLINELTD.	.	9	Electronics	Telecommunications
ELMOSSEMICONDUCTORAG	11.10.1999	9	Electronics	Semiconductors
ELSAAG	15.6.1998	9	Electronics	Software
EM.TV&MERCHANDISINGAG	30.11.1997	6	Media and Advertising	Media
EMPRISEMANAGCONSULTAG	16.7.1999	5	Software	Computers
EMSNEWMEDIAAG	21.11.2000	6	Media and Advertising	Media

ENDEMANN!!!INTERNETAG	10.3.1999	4	Internet	Internet
ENERGIEKONTORAG	25.5.2000	9	Electronics	Energy-Alternate Sources
EUROFINSSCIENTIFIC	.	1	Biotechnology	Environmental Control
EUROMEDAG	16.6.1999	7	Healthcare	Healthcare-Services
EUROMICRONAG	29.6.1998	9	Electronics	Electronics
EVOTECBIOSYSTEMSAG	.	1	Biotechnology	Commercial Services
F.A.M.E.FILM&MUSICENTERT	31.8.2000	6	Media and Advertising	Media
FABASOFTAG	1.10.1999	8	Data Processing	Software
FANTASTICCORP-CTFS	28.9.1999	4	Internet	Internet
FEEDBACKAG	28.6.2000	4	Internet	Internet
FJAAG	21.2.2000	8	Data Processing	Software
FLUXX.COMAG	28.9.1999	4	Internet	Internet
FOCUSDIGITALAG	13.7.2000	6	Media and Advertising	Media
FORISAG	19.7.1999	2	Financial Ser	Diversified Finan Serv
FORTECELEKTRONIKVERTRIEBS	.	9	Electronics	Semiconductors
FORTUNECITY.COMINC	19.3.1999	4	Internet	Internet
FREENET.DEAG	3.12.1999	4	Internet	Internet
FUNKWERKAG	15.11.2000	10	Telecommunications	Electronics
GAPAG	20.9.2000	9	Electronics	Telecommunications
GAUSSINTERPRISEAG	28.10.1999	4	Internet	Internet
GEDYSINTERNETPRODUCTSAG	27.9.1999	4	Internet	Software
GENESCANEUROPEAG	21.7.2000	1	Biotechnology	Healthcare-Services
GENMABA/S-DT.CERTS.(COIS)	18.10.2000	1	Biotechnology	Biotechnology
GERICOMAG	20.11.2000	9	Electronics	Computers
GESELLSCHAFTFUERNETWORKTR	6.8.1997	5	Software	Commercial Services
GFTTECHNOLOGIESAG	28.6.1999	4	Internet	Software
GIGABELLAG *	11.8.1999	4	Internet	Internet
GIRINDUSAG	16.5.2000	1	Biotechnology	Biotechnology
GPCBIOTECHAG	31.5.2000	1	Biotechnology	Biotechnology
GRAPHISOFTNV	8.6.1998	8	Data Processing	Software
GRENKELEASINGAG	4.4.2000	3	Commercial Services	Diversified Finan Serv
GROUPTECHNOLOGIESAG	21.11.2000	8	Data Processing	Internet
H5B5MEDIAAG	21.2.2000	6	Media and Advertising	Media
HAITECAG	14.7.1999	5	Software	Software
HEILERSOFTWAREAG	7.11.2000	4	Internet	Internet
HELKONMEDIAAG	7.10.1999	6	Media and Advertising	Media
HEYDEAGBERATUNGSOFTWARE	14.9.1998	5	Software	Software
HIGHLIGHTCOMMUNICAT-GERMCT	11.5.1999	6	Media and Advertising	Entertainment
HOEFT&WESSELAG	20.7.1998	9	Electronics	Hand/Machine Tools

HUNZINGERINFORMATIONAG	.	3	Commercial Services	Advertising
I:FAOAG	1.3.1999	4	Internet	Leisure Time
IBSAGENGINEERINGCONSULT	21.6.2000	8	Data Processing	Software
I-DMEDIAAG	17.6.1999	4	Internet	Internet
IDSSCHEERAG	11.5.1999	5	Software	Commercial Services
IMINTERNATIONALMEDIAAG	18.5.2000	6	Media and Advertising	Media
INFOGENIEEUROPEAG	25.10.2000	5	Software	Commercial Services
INFOMATECINTEGRATEDINFOSY	3.7.1998	4	Internet	Internet Applications So
INFORBUSINESSSOLUTIONSAG	11.5.1999	8	Data Processing	Software
IN-MOTIONAG	20.6.2000	6	Media and Advertising	Media
INTEGRASA	.	4	Internet	Internet
INTERNETMEDIAHOUSE.COMAG	30.7.1999	4	Internet	Internet
INTERNOLIXAG	27.3.2000	4	Internet	Internet
INTERSHOPCOMMUNICATIONSAG	16.7.1998	4	Internet	Internet
INTERTAINMENTAG	8.2.1999	6	Media and Advertising	Media
INTRAWAREAG	12.5.2000	8	Data Processing	Software
IPCARCHTECAG	7.3.2000	9	Electronics	Distribution/Wholesale
ISIONINTERNETAG	17.3.2000	4	Internet	Internet
ISRAVISIONAG	20.4.2000	9	Electronics	Electronics
ITELLIGENCEAG	.	5	Software	Software
IVUTRAFFICTECHNOLOGIESAG	7.7.2000	5	Software	Software
IXOSSOFTWAREAG	7.10.1998	8	Data Processing	Software
JACKWHITEPRODUCTIONSAG	13.9.1999	6	Media and Advertising	Home Furnishings
JETTERAG	19.8.1999	9	Electronics	Electronics
JOBPILOTAG	5.4.2000	4	Internet	Commercial Services
JUMPTECINDUSTRIELLECOMPUTE	26.3.1999	9	Electronics	Semiconductors
KABELNEWMEDIA	15.6.1999	4	Internet	Internet
KINOWELTMEDIENAG*	12.5.1998	6	Media and Advertising	Media
KLEINDIENSTDATENTECHNIK	2.6.1999	8	Data Processing	Software
KONTRONEMBEDDEDCOMPUTERS	6.4.2000	9	Electronics	Semiconductors
KRETZTECHNIKAG	27.3.2000	7	Healthcare	Healthcare-Products
LAMBDAPHYSIKAG	21.9.2000	9	Electronics	Electronics
LETSBUYIT.COMNV	21.7.2000	4	Internet	Internet
LINOSAG	4.9.2000	9	Electronics	Electronics
LINTECCOMPUTERAG	7.9.1998	9	Electronics	Computers
LIONBIOSCIENCEAG	11.8.2000	1	Biotechnology	Software
LIPROAG	15.10.1999	8	Data Processing	Software
LOBSTERNETWORKSTORAGEAG	12.5.1998	9	Electronics	Software
LPKFLASER&ELECTRONICS	30.11.1998	9	Electronics	Electronics

LYCOSEUROPEN.V.	22.3.2000	4	Internet	Internet
M+SELEKTRONIKAG	29.2.2000	5	Software	Computers
MACROPOREINC	10.8.2000	1	Biotechnology	Healthcare-Products
MANAGEMENTDATASOFTWAREEN G	22.6.1999	8	Data Processing	Software
MANIATECHNOLOGIEAG	26.7.1999	9	Electronics	Semiconductors
MATCHNETPLCSPONSREGSGDR	27.6.2000	6	Media and Advertising	Internet
MAXDATACOMPUTERAG	9.6.1999	9	Electronics	Computers
MBSOFTWAREAG	17.11.1998	8	Data Processing	Software
MEDIA!AG	29.6.2000	6	Media and Advertising	Media
MEDIA[NETCOM]JAG	5.7.2000	6	Media and Advertising	Internet
MEDIANTISAG	5.7.1999	4	Internet	Internet
MEDIASCAPECOMMUNICATIONSAG	22.5.2000	4	Internet	Internet
MEDIGENEAG	30.6.2000	1	Biotechnology	Biotechnology
MEDIONAG	26.2.1999	9	Electronics	Distribution/Wholesale
MENSCHUNDMASCHINESOFTWARE	21.7.1997	8	Data Processing	Software
METABOXAG*	7.7.1999	9	Electronics	Telecommunications
MICROLOGICAAG*	21.9.1998	3	Commercial Services	Software
MICROLOGLOGISTICSAG	28.6.2000	3	Commercial Services	Transportation
MICRONASSEMICONDUCTOR-REG	15.7.1999	9	Electronics	Semiconductors
MISAG	15.2.2000	8	Data Processing	Software
MMEME,MYSELF&EYEENTERTA	20.11.2000	6	Media and Advertising	Media
MOBILCOMAG	10.3.1997	10	Telecommunications	Telecommunications
MORPHOSYSAG	9.3.1999	1	Biotechnology	Biotechnology
MOSAICSOFTWAREAG	1.7.1999	8	Data Processing	Software
MOUNT10INC	11.2.2000	5	Software	Software
MSHINTERNATIONALSERVICEAG	10.9.1999	.	.	.
MUEHLBAUERHOLDINGAG&CO	10.7.1998	9	Electronics	Machinery-Diversified
MUEHLPRODUCT&SERVICEAG	25.8.1995	3	Commercial Services	Building Materials
MUSICMUSICMUSICINC	1.10.1999	4	Internet	Internet
MWG-BIOTECHAG	7.5.1999	1	Biotechnology	Biotechnology
NEMETSCHEKAG	10.3.1999	8	Data Processing	Software
NETAGINFRASTRUCTURESOFT	17.3.2000	4	Internet	Internet
NETLIFEAG	1.6.1999	4	Internet	Computers
NEUESENTIMENTALFILMAG	21.11.2000	6	Media and Advertising	Advertising
NEXUSAG	24.7.2000	5	Software	Software
NORCOMINFORMATIONTECHNOLO G	30.9.1999	8	Data Processing	Software
NOVASOFTAG	15.11.1999	5	Software	Commercial Services
NOVEMBERAG	10.4.2000	1	Biotechnology	Pharmaceuticals

NSESOFTWAREAG	20.4.1999	8	Data Processing	Software
ODEONFILMAG	12.4.1999	6	Media and Advertising	Entertainment
ONVISTAAG	28.2.2000	4	Internet	Internet
OPENSHOPHOLDINGAG	21.3.2000	4	Internet	Internet
ORADHI-TECHSYSTEMSLTD	16.11.1999	8	Data Processing	Computers
ORBISAG	25.9.2000	5	Software	Software
OTIONTRACKINNOVATIONSLTD	31.8.1999	9	Electronics	Electronics
P&IPERSONAL&INFORMATIKAG	7.7.1999	8	Data Processing	Software
P&TTECHNOLOGYAG	28.11.2000	9	Electronics	Electrical Compo & Equip
PANDATELAG	2.11.1999	10	Telecommunications	Telecommunications
PANKLRACINGSYSTEMSAG	.	9	Electronics	Auto Parts & Equipment
PARAGONAG	29.11.2000	9	Electronics	Electronics
PARSYTECAG	16.6.1999	8	Data Processing	Software
PC-SPEZIALISTFRANCHISEAG	25.8.1999	9	Electronics	Retail
PC-WAREAG	5.5.2000	8	Data Processing	Computers
PFEIFFERVACUUMTECHNOLOGY	16.7.1996	3	Commercial Services	Machinery-Diversified
PGAMADVANCEDTECHNOLOGIES	14.9.2000	5	Software	Commercial Services
PHENOMEDIAAG	22.11.1999	6	Media and Advertising	Software
PIRONETAG	22.2.2000	8	Data Processing	Internet
PIXELNETAG	21.6.2000	4	Internet	Retail
PIXELPARKAG	4.10.1999	4	Internet	Internet
PLAMBECKNEUEENERGIEN-REG	15.12.1998	9	Electronics	Energy-Alternate Sources
PLASMASELECTAG	1.3.2000	1	Biotechnology	Healthcare-Products
PLAUTAG	9.11.1999	3	Commercial Services	Commercial Services
PLENUMAG	3.8.1998	5	Software	Computers
POETHOLDINGSINC	16.11.1999	8	Data Processing	Software
POPNETINTERNETAG	2.2.2000	4	Internet	Computers
PRIMACOMAG	22.2.1999	10	Telecommunications	Media
PROACTAAG	7.6.1999	5	Software	Software
PRODVSOFTWAREAG	22.3.2000	8	Data Processing	Software
PROUTAG	27.4.1999	8	Data Processing	Commercial Services
PSBAGFUERPROGRAMMIERUNG	27.7.1999	5	Software	Computers
PSIAGGESELLSCHAFT	31.8.1998	8	Data Processing	Software
QIAGENN.V.	.	1	Biotechnology	Biotechnology
QSCOMMUNICATIONSAG	19.4.2000	4	Internet	Internet
REALTECHAG	26.4.1999	5	Software	Commercial Services
REFUGIUMHOLDINGAG*	25.8.1997	7	Healthcare	Healthcare-Services
RHEINBIOTECHN.V.	21.4.1999	1	Biotechnology	Biotechnology
RICARDO.DEAG	21.7.1999	.	.	.

ROESCHMEDIZINTECHNIKAG	24.2.2000	7	Healthcare	Healthcare-Products
RTRIASOFTWAREAG	10.5.1999	.	.	.
RTVFAMILYENTERTAINMENT	8.6.1999	6	Media and Advertising	Entertainment
RUECKERAG	15.5.2000	3	Commercial Services	Software
SACHSENRINGAUTOMOBILTEC	2.10.1997	3	Commercial Services	AutoParts & Equipment
SALTUSTECHNOLOGYAG	14.7.1997	3	Commercial Services	AutoParts & Equipment
SANOHEMIAPHARMAZEUTIKAAG	12.5.1999	1	Biotechnology	Pharmaceuticals
SAPSYSTEMSINTEGRATIONAG	13.9.2000	5	Software	Computers
SCMMICROSYSTEMSINC	.	9	Electronics	Computers
SECUNETSECURITYAG	9.11.1999	5	Software	Computers
SENATORENTERTAINMENTAG	29.1.1999	6	Media and Advertising	Media
SERSYSTEMEAG	14.7.1997	8	Data Processing	Software
SHSINFORMATIONSSYSTEMEAG	19.5.1999	5	Software	Computers
SILICONSENSORINTLAG	15.7.1999	9	Electronics	Electronics
SINGULUSTECHNOLOGIES	25.11.1997	9	Electronics	Machinery-Diversified
SINNERSCHRADERAG	2.11.1999	4	Internet	Internet
SOFTINGAG	16.5.2000	9	Electronics	Electronics
SOFTLINEAG	14.2.2000	8	Data Processing	Computers
SOFTMATICAG	1.6.1999	8	Data Processing	Software
SOFTMSOFTWAREUNDBERATUNG	21.7.1998	8	Data Processing	.
SPLENDIDMEDIENAG	24.9.1999	6	Media and Advertising	Media
STEAGHAMATECHAG	12.5.1999	9	Electronics	Machinery-Diversified
SUESSMICROTEC	18.5.1999	9	Electronics	Semiconductors
SUNBURSTMERCHANDISINGAG*	27.9.1999	6	Media and Advertising	Commercial Services
SUNWAYSAG	9.2.2001	9	Electronics	Electrical Compo & Equip
SWINGI!ENTERTAINMENTMEDIA	2.2.2000	6	Media and Advertising	Software
SYSKOPLANAG	2.11.2000	5	Software	Software
SYSTEMATICSAG	27.9.1999	5	Software	Computers
SYZYGYAG	6.10.2000	4	Internet	Internet
SZTESTSYSTEMEAG	2.6.1999	9	Electronics	Electronics
TDSINFORMATIONSTECHNOLOGIE	26.6.1998	5	Software	Computers
TEAMCOMMUNICATIONSGROUP	.	6	Media and Advertising	Media
TEAMWORKINFMANAG*	14.7.1999	4	Internet	Software
TECHNOTRANS	10.3.1998	9	Electronics	Machinery-Diversified
TELDAFAXAG*	.	10	Telecommunications	Telecommunications
TELEATLASBV	26.5.2000	9	Electronics	Software
TELEGATEAG	22.4.1999	10	Telecommunications	Telecommunications
TELEPLANINTERNATIONALNV	23.11.1998	3	Commercial Services	Computers
TELESAG	30.6.1998	10	Telecommunications	Telecommunications

TELESENSKSLAG	21.3.2000	10	Telecommunications	Software
TEPLAAG	21.6.1999	9	Electronics	Semiconductors
THIELLOGISTIKAG	20.3.2000	3	Commercial Services	Software
TIPTELAG	1.7.1992	10	Telecommunications	Telecommunications
TISCONAGINFOSYSTEMS	14.10.1999	5	Software	Software
TOMORROWINTERNETAG	30.11.1999	4	Internet	Media
T-ONLINEINTERNATIONALAG	17.4.2000	4	Internet	Internet
TRANSTECAG	3.4.1998	9	Electronics	Computers
TRAVEL24.COM	15.3.2000	4	Internet	Internet
TRIASOFTWAREAG	10.5.1999	5	Software	Software
TRINTECHGROUP-ADR	24.9.1999	4	Internet	Software
TRIOUSAG	9.3.2000	10	Telecommunications	Telecommunications
TTLINFORMATIONTECHNOLOGY	12.7.1999	5	Software	Computers
TV-LOONLANDAG	22.3.2000	6	Media and Advertising	Media
UMSUNITEDMEDICALSYSINTL	17.7.2000	7	Healthcare	Healthcare-Services
UMWELTKONTORRENEWABLEENER	5.7.2000	9	Electronics	Energy-Alternate Sources
UNITEDINTERNETAG-REGSHARE	23.3.1998	4	Internet	Advertising
UNITEDLABELSAG	10.5.2000	6	Media and Advertising	Commercial Services
UNITEDVISIONSENTERTAINMENT	20.6.2000	6	Media and Advertising	Media
UPDATE.COMSOFTWARE	11.4.2000	8	Data Processing	Internet
USUSOFTWAREHAUSUNTERNEHMEN	4.7.2000	8	Data Processing	Software
UTIMACOSAFEWAREAG	16.2.1999	8	Data Processing	Computers
VALORCOMPUTERIZEDSYSTEMS	15.5.2000	8	Data Processing	Software
VARETISAG	7.2.2000	10	Telecommunications	Telecommunications
VECTRONSYSTEMSAG	16.6.1999	9	Electronics	Computers
VI[Z]RT	8.11.1999	9	Electronics	Electronics
VISIONIXLIMITED	1.2.2000	6	Media and Advertising	Media
VIVAMEDIAAG	19.7.2000	5	Software	Software
W.E.T.AUTOMOTIVESYSTEMSAG	28.4.1998	3	Commercial Services	Auto Parts & Equipment
WAPMESYSTEMSAG	5.7.2000	4	Internet	Internet
WAVELIGHTLASERTECHNOLOGIE	15.9.1999	7	Healthcare	Healthcare-Products
WEB.DEAG	17.2.2000	4	Internet	Internet
WINTERAG	25.9.2000	9	Electronics	Electronics
WIZCOMTECHNOLOGIESLTD	29.3.1999	9	Electronics	Computers
WWLINTERNETAG	15.7.1999	4	Internet	Internet

Total 343 firms

*Denotes firm insolvency as of July 11, 2001.