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Survival of New Firms in an Industry Agglomeration: An Empirical Analysis Using Tokyo Telephone Directories from the 1980s

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My purpose in this essay is to examine the impact of industry agglomeration on the survival of new firms, using a unique dataset from Tokyo business telephone directories in the 1980s. I focus on the largest agglomeration of the metal and machinery industries in Japan, Ota Ward in Tokyo, at its peak. I found 1,603 start-up firms in the manufacturing sector in Ota in three cohorts in the first half of the 1980s, checked their survival five years later, and econometrically analyzed the influence of industry agglomeration on their survival. The empirical results suggest the positive and significant effects of industry agglomeration on start-up firms' chance of survival, but only for the sub-sample of joint-stock companies.

Several scholars have debated and investigated the benefits of industry agglomeration. Alfred Marshall and Paul Krugman identified three factors that contribute to its advantages: labor market pooling, specialized inputs, and technological spillovers.[1] Based on case studies of some manufacturing clusters in Japan, Hideki Yamawaki concluded that the most important benefits of industry agglomeration are specialization, easy procurement of resources, diffusion of technology, and public policy

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[1] See Alfred Marshall, *Principles of Economics* (London, 1890), and Paul Krugman, *Geography and Trade* (London, 1991).

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support.[2] Based on a recent questionnaire survey, the Small and Medium Enterprise Agency reports recognize that the major advantages of industry agglomeration to local firms are the easy access to market and technological information through intensive communication.[3] I argue that these advantages of industry agglomeration encourage the start-up and entry of new firms and support existing firms by improving their productivity and competitiveness.[4]

Industry agglomeration may also have negative effects on local firms' performance. The geographical proximity of many firms in the same industry, can create strong competitive pressures, which could lead to the exit of relatively inefficient incumbents and discourage the entry of new firms. Therefore, the effect of industry agglomeration depends on the balance of its advantages and disadvantages, and social network development plays a crucial role.

Thus far, industry agglomeration has attracted less attention from business history researchers than it deserves; agglomeration can play a major role in promoting innovation and competitiveness of regional firms through the spillover of knowledge and the availability of qualified business resources. Thus, the life cycle of local firms depends on their local environments.

Although a great deal of attention has been paid to industry agglomeration and start-up firms from a microeconomic perspective, few researchers focus directly on the relationship between industry agglomeration and start-up activities. Scholars studying the performance of start-up firms based on the industrial organization approach have paid scant attention to the role of industry agglomeration, while those concerned with spatial and regional economics have rarely been concerned with firms' post-entry performance. Thus, my primary purpose in this essay is to bridge the gap in previous studies by examining the effect of industry agglomeration on the survival of new firms.

There are neither comprehensive statistical sources nor databases of business start-ups and failures in Japan. Previous researchers examining Japanese start-up firms use micro data from official statistics, such as the Establishment and Enterprise Census, or from client firms of the National Life Finance Corporation (Kokumin Seikatsu Kin'yu Koko, a public financial institution for entrepreneurs and small businesses), or databases of the private companies for credit research, such as Tokyo Shoko

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[2] See Hideki Yamawaki, "The Evolution and Structure of Industrial Clusters in Japan," *Small Business Economics* 18 (Feb. 2002): 121-40.

[3] See Small and Medium Enterprise Agency, *Chusho Kigyo Hakusho, 2003* [White Paper of Small and Medium Enterprises, 2003] (Tokyo, 2003).

[4] Using regional- and industry-level data from Japan, Eiichi Tomiura found that local knowledge spillovers and immobile specialized labor affect regional employment growth; see Eiichi Tomiura, "Changing Economic Geography and Vertical Linkages in Japan," *Journal of the Japanese and International Economies* 17 (Dec. 2003): 561-81.

Research. However, these sources cannot adequately capture business start-ups and failures; thus, I use a unique dataset of start-up firms derived from the telephone directory.

I focus on Ota Ward in Tokyo at the end of its heyday, the first half of the 1980s. Ota Ward is the largest and the best-known agglomeration of the metal and machinery industries in Japan.[5] While some previous researchers employed a cross-sectional analysis of several districts with different levels of industry agglomeration, I use a cross-section sample of business fields and industries within an area, with different levels of industry agglomeration.

Previous Literature

There are a growing number of econometric studies on the determinants of new firm survival based on large samples, especially in the United States, the United Kingdom, and Germany. Most industrial organization and entrepreneurship studies, however, focus on firm-specific factors (such as start-up size, operating years, and legal form), industry-specific factors (for example, market size, demand growth, average profitability, capital intensity, and innovativeness), or founder-specific factors (such as gender, age, education level, job experience, and management experience).[6] Researchers have paid scant attention to the role of firm location and industry agglomeration.

With regard to Japan, Yuji Honjo's recent studies are representative. Using data from the Tokyo Shoko Research company database, he showed that industry agglomeration has a negative effect on the survival of new firms because of increased competition.[7] Shinya Kinukawa and Kou Yukawa investigatd the formation of a unique agglomeration of Internet firms in a particular area of Tokyo, using a dataset from the telephone directory; however, they did not examine the effects of this agglomeration.[8]

Authors of empirical studies based on urban and regional economics have not paid much attention to the post-entry performance of start-up firms. They were more concerned with the post-entry relocation patterns of those firms than with their survival. A few researchers have focused on

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[5] In this paper, we group seven industries (iron and steel, nonferrous metals, metal products, general machinery, electric machinery, transportation equipment, and precision instruments) as "metal and machinery industries."

[6] See David Storey, *Understanding the Small Business Sector* (London, 1994), for a literature survey.

[7] See Yuji Honjo, "Business Failure of New Software Firms," *Applied Economics Letters* 7 (Sept. 2000): 575-79, and Yuji Honjo, "Business Failure of New Firms: an Empirical Analysis Using a Multiplicative Hazards Model," *International Journal of Industrial Organization* 18 (May, 2000): 557-74.

[8] See Shinya Kinukawa and Kou Yukawa, "Netto kigyo shuseki no joken" [Determinants of Agglomeration of Internet Firms], *Fujitsu Research Institute Research Report* no. 99, Dec. 2000.

the impact of local factors on the survival chances of new firms. Timothy M. Stearns, Nancy M. Carter, Paul D. Reynolds, and Mary L. Williams found that new U.S. firms in urban locations have significantly worse survival chances than those in rural locations, counter to their hypothesis.[9] By estimating a hazard function using Greek data, Georgios Fotopoulos and Helen Louri showed that new firms located in the greater Athens urban area have significantly better chances of survival than those located in other regions.[10]

While these researchers focus on the effects of location, Michael P. Devereux, Rachel Griffith, and Helen Simpson provide evidence from the United Kingdom that plant survival rates are higher in more agglomerated industries, measuring agglomeration as geographical concentration in excess of expectations, given the industrial concentration.[11]

To sum up, in recent empirical studies researchers have paid little attention to the influence of industry agglomeration, and the empirical evidence to date has been mixed. In previous studies scholars mostly compare urban and rural locations or estimate the effect of the different levels of agglomeration using data from several locations countrywide; I concentrated on a single, relatively narrow area, Ota Ward in Tokyo.

Industry Agglomeration in Ota Ward, Tokyo

Ota, one of the twenty-three central wards in Tokyo Metropolitan Prefecture, has an area of 60 square kilometers and lies in the far south of Tokyo, bounded by Tokyo Bay on the east and the Tama River on the south and west. Along with Kawasaki and Yokohama in Kanagawa Prefecture in the south, and Minato, Shinagawa, and Meguro wards in Tokyo in the north, it forms the Keihin Industrial District. Ota is famous for the large scale and scope of agglomeration of the metal and machinery industries, with a high proportion of very small firms that are distinguished for their flexible and superior skills. Ota has been the subject of numerous investigations, mainly by industrial sociologists in Japan; however, few scholars have conducted econometric studies. Moreover, with the exception of D. Hugh Whittaker's work, no detailed information on Ota and its industries is available in English.[12] Therefore, Ota Ward's popularity in Japan has not extended worldwide.

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[9] See Timothy M. Stearns, Nancy M. Carter, Paul D. Reynolds, and Mary L. Williams, "New Firm Survival: Industry, Strategy, and Location," *Journal of Business Venturing* 10 (Jan. 1995): 23-42.

[10] See Georgios Fotopoulos and Helen Louri, "Location and survival of new entry," *Small Business Economics* 14 (June 2000): 311-21.

[11] See Michael P. Devereux, Rachel Griffith, and Helen Simpson, "The Geographic Distribution of Production Activity in the UK," *Regional Science and Urban Economics* 34 (Sept. 2004): 533-64.

[12] D. Hugh Whittaker, *Small Firms in the Japanese Economy* (Cambridge, U.K., 1997).

Ota Ward is recognized as the leading ward in Tokyo with regard to the number of factories, employment, and output, and as the largest agglomeration of metal and machinery industries in Japan. According to the Establishment and Enterprise Census of 2001, there were 7,117 manufacturing establishments in Ota, which accounted for 9.0 percent of the total number of manufacturing establishments in Tokyo and 1.1 percent of those in Japan. Among the 7,117 Ota factories, 5,450 (77 percent) belonged to metal and machinery industries, concentrated in the metal products (1,517) and general machinery (2,152) industries. Ota has twice the average share of the metal and machinery industries both in Tokyo and in the entire country (38 percent of each).

A high proportion of firms comprised of fewer than five persons (as employers and employees) also characterize the industry agglomeration in Ota Ward. According to the Establishment and Enterprise Census of 2001, 58 percent of the manufacturing establishments in Ota are such micro firms. The factories in Ota employ an average of ten people. Compared to the data for the entire country (in which 49 percent are micro firms, and the average business size is seventeen employees), such a high presence of micro firms in Ota is remarkable.

The industry agglomeration in Ota peaked in the first half of the 1980s, with over 10,000 factories and 125,000 people engaged in the manufacturing sector.[13] More than three-quarters of the total number of factories (77 percent) and the total number of workers engaged (78 percent) belonged to the metal and machinery industries (see Figures 1 and 2). According to Mitsuhiro Seki and Hideo Kato, almost 90 percent of the factories established between 1965 and 1985 belonged to these industries.[14]

In the following twenty years, however, the number of factories steadily decreased by 30 percent (see Figure 1), while the share of the metal and machinery industries remained unchanged (see Figure 2). The annual start-up ratio (the number of start-up firms compared to the number of existing firms) in the manufacturing sector in Japan declined from 3.1 percent in 1981-1986 to 1.6 percent in 1999-2001, and the decline of the manufacturing sector during the early 2000s was more evident in Ota.[15]

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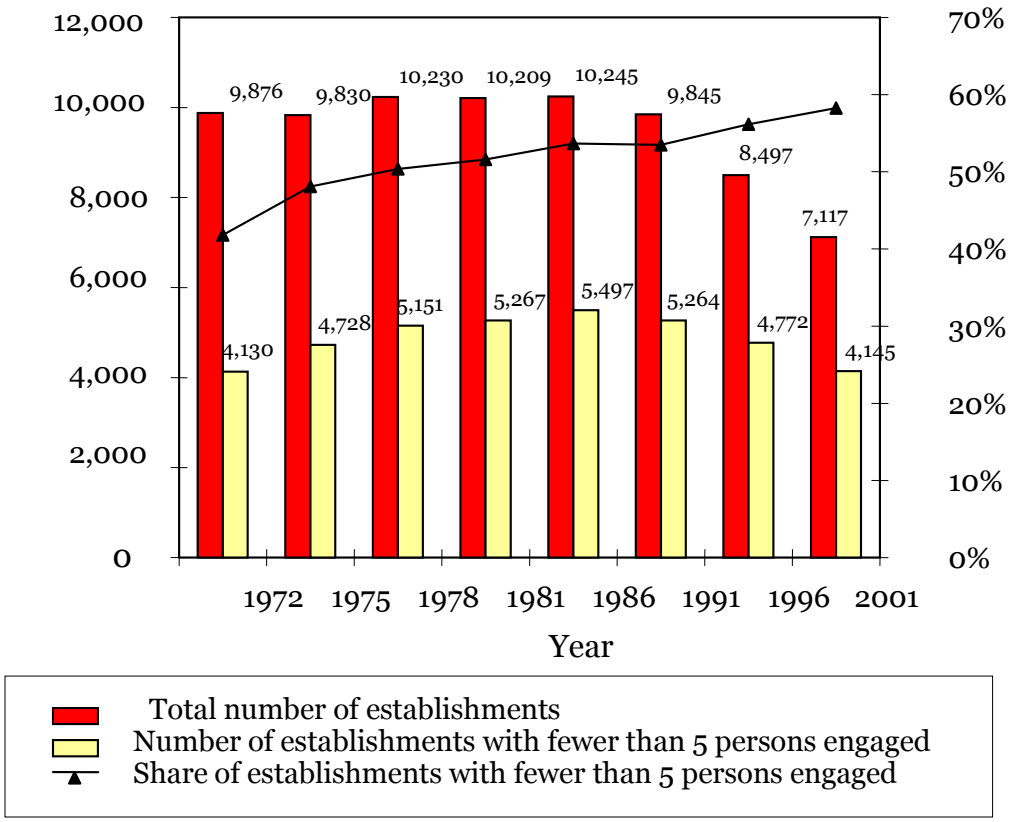
[13] See Whittaker, *Small Firms in the Japanese Economy*, 63-69, for a compact survey of the historical development of industry agglomeration in Ota.

[14] See Mitsuhiro Seki and Hideo Kato, *Gendai nihon no chusho kikai kogyo* [Small and Medium Machinery Firms in Contemporary Japan] (Tokyo, 1990), 31.

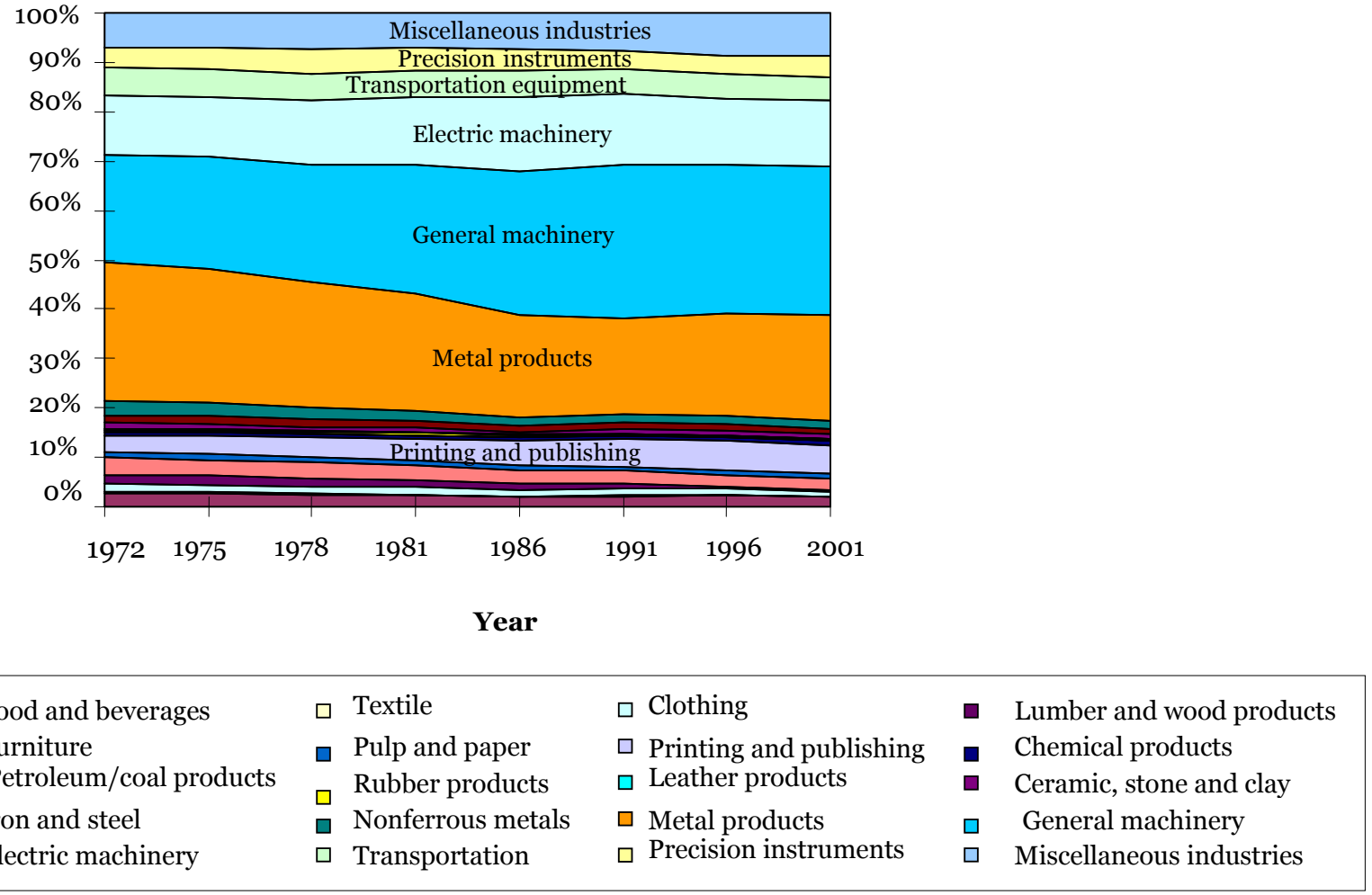
[15] See Small and Medium Enterprise Agency, *Chusho Kigyo Hakusho, 2002* [White Paper of Small and Medium Enterprises, 2002] (Tokyo, 2002), 87. From 1981 to 2001, the number of manufacturing establishments decreased by 30 percent in Ota, as compared to the national average of 25 percent. There are some complex reasons for the industrial decline of urban industry agglomerations such as Ota, including conflicts with neighboring residents, increases in real estate prices and rents, and industrial "hollowing-out."

FIGURE 1
Number of Businesses in the Ota Manufacturing Sector, 1972-2001



Sources: Establishment and Enterprise Census, various issues.

FIGURE 2
Structure of the Manufacturing Sector in Ota, 1972-2001



Sources: Establishment and Enterprise Census, various issues.

Because our purpose was to examine the effect of industry agglomeration on the post-entry performance of start-up firms, we focused on the first half of the 1980s—the end of the heyday of Ota's industry agglomeration—in order to obtain a sufficient number of start-up firms in our sample. Another distinct feature of the industry agglomeration in Ota is that "all the processes needed to make machines are found within the ward . . . including materials, basic processes, basic parts, and plastic moulds."[16] Given the enormous number of micro firms, the Ota industry agglomeration includes a variety of processing functions in the metal and machinery industries.

According to the authors of a large-scale survey in 1985, only 11 percent of the factories belonging to these industries were "product makers," producing finished products of their own.[17] They were supported by other factories engaged in various processes such as machining, sheet-metal processing, pressing, welding, casting, forging, painting, plating, heat treatment, manufacture of jigs, tools, and molds, and plastic molding.[18] Most firms were engaged in a diverse range of products or processes instead of specializing in a specific product or process. These firms were particularly important in dealing with rush orders in small batches. In this sense, we can regard Ota as a "highly flexible specialized industrial district."[19]

There were many micro factories with fewer than four employees in Ota embedded in the local trading network: 52 percent of the customers and 69 percent of the suppliers were located in Ota Ward.[20] Both customers and suppliers were often involved in the same process as the micro factories themselves, because they often placed supplementary orders with each other for work beyond their capacity. This type of relationship is termed *nakama torihiki* or "confrere trading."[21] The intensity of such horizontal inter-firm linkages is a major source of the competitive strength of the small firms in Ota.

In sum, we can characterize the agglomeration of the metal and machinery industries in Ota not only by the large number and high proportion of small firms, but also by their involvement in various processing activities and confrere trading in the local business network. We expect that these characteristics support the survival and development of start-up firms.

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[16] Whittaker, *Small Firms in the Japanese Economy*, 71.

[17] Seki and Kato, *Gendai nihon no chusho kikai kogyo*, 115.

[18] Machining is the largest group among these, with 37 percent of the surveyed factories in the metal and machinery industries engaged mainly in this activity.

[19] Whittaker, *Small Firms in the Japanese Economy,* 73.

[20] Seki and Kato, *Gendai nihon no chusho kikai kogyo*, 181 and 204.

[21] Ibid., 109; this is defined as "trading relations between similarly sized firms which are not product makers."

Data and Sample

Our data source was the telephone directory. To date, with the exception of Shinya Kinukawa and Kou Yukawa, researchers have not carried out empirical studies using data from telephone directories. Their study used telephone directory data to count the number of existing firms and new firms in the Internet-related industries in a central area of Tokyo, in order to examine the reason behind the formation of such a specialized agglomeration in that location. We used telephone directory data to examine the effect of industry agglomeration on the survival of new firms in the manufacturing sector.

We gathered our sample data from the business telephone directories of the twenty-three central wards in Tokyo in June 1980, December 1981, June 1983, and December 1984.[22] Until 1984, these directories comprised the business-to-business section (*Sangyo-hen* or *Business Tokyo*) and the business-to-customer section (*Seikatsu-hen* or *Living Tokyo*) and were issued at approximately eighteen-month intervals. Because *Seikatsu-hen* was issued six months after *Sangyo-hen*, they were not renewed simultaneously. In 1986, the reorganization into three sections in alphabetical order by business field resulted in substantial changes in the classification of these fields. Since October 1987, there has been an annual edition of the integrated business telephone directory.

We drew our data solely from the business-to-business section of the directory for two reasons. First, we assumed that the sections duplicate some business fields and many firms. Second, our analysis focuses on the agglomeration effect of the manufacturing industries, and it is difficult to distinguish the manufacturing establishments from the sales and service establishments in most of the business fields in *Living Tokyo*. Thus, our sample may not accurately represent the manufacturing industries in Tokyo, but, rather, may be biased toward the metal and machinery industries, which are largely characterized by business-to-business transactions.[23]

Old Tokyo telephone directories are very difficult to procure. Even the NTT-subsidiary that publishes and distributes telephone directories does

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[22] We use the directories issued during the first half of the 1980s because this is the last period with vital start-up activities in Ota. Additionally, to check the survival of start-up firms, we use another category of the telephone directory, "Hellopage," which lists individual names and phone numbers in alphabetical order.

[23] According to the *Census of Establishments 1981*, 77 percent of the business establishments in the manufacturing sector in Ota belonged to the metal and machinery industries. The corresponding ratio from the telephone directory in the same year is 81 percent. This suggests that the sampling bias from using only *Sangyo-hen* or *Business Tokyo* may be negligible.

not have them in stock.[24] The only library that holds them is the Tokyo Metropolitan Library, where we found a collection of the telephone directories of the twenty-three central wards of Tokyo since 1970.

There are some advantages to using telephone directories as a data source. First, the telephone directory may be the most comprehensive source of new and existing firms. The Establishment and Enterprise Census of the Statistics Bureau, which is often used to estimate the number of start-ups and closures, is based on the business establishment of firms, and may not capture manufacturers working at home or operating at the factories of their previous employers.[25] Other official statistics also have their limitations.[26] Further, private firm databases for credit information, such as Teikoku Data Bank and Tokyo Shoko Research, by focusing on incorporated companies, cover only some new and small firms, providing an upwardly biased sample.

Second, the telephone company updates its directory more often (every 1.5 years until 1985 and every year since then) than the Establishment and Enterprise Census, which conducts its survey every three to five years. Because many start-up firms are short-lived, briefer survey intervals can capture more start-up firms and provide opportunities for more detailed analysis of their survival or failure. Other official statistics that annually survey firms and establishments are much less comprehensive.

Third, micro data from the telephone directory are available free of charge, while micro data from official statistics are not available for public use, and those from private databases are quite expensive and do not capture start-up firms comprehensively. Without micro data on individual firms or establishments, the possibility of econometric analyses is restricted.

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[24] NTT collects old issues and scraps them to protect personal information. We obtained permission from NTT to use data from old telephone directories on condition that we would make no personal information available to a third party.

[25] For example, there were several cases of skilled workers operating from the factories of their previous employers, a situation that official statistics may not include. This may be one reason why the number of manufacturers in the telephone directory is much larger (indeed, twofold) than in the statistics.

[26] The Census of Manufacturers of the Ministry of Economy, Trade, and Industry (METI), which targets firms and establishments in the manufacturing sector, relies on the Establishment and Enterprise Census for the list of establishments to survey, and thus has the same limitations in capturing the number of new business start-ups. Moreover, this census surveys all the establishments only every two or three years (those years ending with zero, 3, 5, and 8). For the remaining years, they do not survey establishments with fewer than four employees. The annual report on employment insurance of the Ministry of Health, Labor, and Welfare deals only with establishments with employees. The Ministry of Justice statistics of incorporation registration provides information only for incorporated firms. The same restriction applies to the Tax Administration Agency's annual report on corporation tax.

Although these reasons support the use of telephone directory data, we should be aware of their limitations. First, the information available about the sample firms is limited to names, addresses, phone numbers, legal forms, and business classifications. Second, the directory may not list all firms, as it is not compulsory for firms to install a phone and list their numbers. It is difficult to imagine manufacturing firms without phone connections, however, and getting the firm listed in the telephone directory is not only inexpensive and convenient, but also an effective form of advertising, particularly useful for new firms. Therefore, we assume that every start-up firm in the manufacturing sector will list its phone number in the directory.

Third, and more important, new firms in the directory are not necessarily real start-ups. We may regard them as "new firms" because of changes in their names, addresses, or business classifications. A similar, more critical restriction applies to firm exits—that is, when a firm disappears from the directory.

To identify new manufacturing firms among all the firms listed in the telephone directory, we first had to exclude non-manufacturers. We eliminated business fields such as foreign trading, advertising, real estate, construction, agriculture, forestry, and fishery, as well as commerce, repairs, and services. We also excluded those manufacturing industries that consist mostly of sales or repairs, such as those manufacturing "bicycles," "motorbikes," and "cosmetics."

Our first step involved identifying recently listed firms and recently unlisted firms by comparing one issue of the telephone directory with the next for each business field.[27] For example, we compared the firms listed in the business field "manufacturers of tools" in the June 1980 and December 1981 directory issues. We identified firms not listed in the 1980 issue but listed in the 1981 issue as "recently listed firms," and those listed in the old issue but not in the new were identified as "recently unlisted firms." In this manner, we identified 2,980 recently listed firms and 3,532 recently unlisted firms for three start-up cohorts (June 1980-December 1981, December 1981-June 1983, and June 1983-December 1984).

In the second step, we identified "real" start-up firms from among these "newcomers." Initially, we compared recently listed firms and recently unlisted firms in the same cohort to check and correct any overlap. Such "double counting" stemmed from the changes in business fields, names, addresses, or phone numbers of firms.[28] We thus excluded

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[27] In the business telephone directory, we found not only company names, but also several personal names. Hereafter, "firms" include both companies and sole proprietors.

[28] To determine if a new firm is really a new start-up or an existing firm that changed its name and/or address, we considered cases where at least the name and the address or the name and the business field were different from those in the previous issue new start-ups, and other cases to be existing firms. We could

as many as possible of the existing firms from other Tokyo wards that entered into Ota.[29] In addition, in some cases firms diversify their business activities and list themselves in other business fields at an extra fee. We excluded those cases as well as firms and establishments engaged in non-manufacturing activities such as sales and repairing establishments, research laboratories, warehouses, and logistics centers. We identified several non-manufacturing subsidiaries of existing firms among these groups.

After excluding these "seemingly new" firms and non-manufacturing firms, 1,603 "real" start-up firms remained in the three cohorts. We used this sample as pooled data for the empirical analysis, controlling for different start-up periods by using cohort dummies (see Table 1).

TABLE 1
Start-Up Firms and Surviving Firms from Telephone Directory Data

Cohort	Recently Listed Firms	Start-up Firms	Surviving Firms	Survival Ratio	Adjusted Ratio
1	950	519	366	.71	.74
2	958	528	314	.60	.61
3	1,072	556	377	.68	.77
All	2,980	1,603	1,057	.66	.71

Note: We adjusted different durations of each period to 60 months.

We discovered that in June 1980 there were 14,740 (business-to- business) manufacturers in Ota.[30] Thus, the net start-up ratio (the number of start-up firms divided by the number of existing firms at the beginning of the period) in the observation period (4.5 years) is 10.9 percent and the average annual start-up ratio is 2.4 percent. Because of a possible overestimation of the denominator, this start-up ratio may be underestimated.

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often relate new names to old (same family name, incorporation of sole proprietors, and so forth).

[29] Because we used only directories from the twenty-three wards of Tokyo, we could not check relocation of firms into Ota from areas outside those wards. Thus, our sample may contain new entries of existing firms into Ota.

[30] According to the official statistics, there were approximately 10,200 establishments in the manufacturing sector in Ota in 1978 and 1981. Our estimate based on the telephone directory is much higher, even though our estimation excludes typical consumer goods industries. A possible reason for this large difference is that telephone directories may list manufacturers that official statistics do not capture (such as those operating from the factories of their previous employers). However, it is also possible that these 14,742 establishments include non-manufacturing establishments and cases of double or multiple counting of firms.

The start-up ratios for the three cohorts are 3.5, 3.6, and 3.9 percent, respectively, with adjusted annual ratios of 2.4, 2.4, and 2.6 percent, respectively.

Start-up firms are concentrated in some metal and machinery industry business fields, as shown in Table 2. Forty percent of the start-up firms belong to the top five fields: "machinery industry," "electric machinery, and equipments," "sheet metal processing," "dyes and molds" and "machine tools." Approximately 60 percent of the start-up firms are concentrated in ten business fields, among which eight fields directly belong to the metal and machinery industries. We can also characterize these business fields as having relatively high start-up ratios. Verifying the survival of the start-up firms is at least as complicated as identifying them. We verify the survival of the start-up firms for each cohort using a later (by approximately five years) issue of the directory.[31] Thus, we regard firms also listed in the later issue as having survived. However, we face some difficulties in identifying the survived firms.

The first major problem is that closed factories may not necessarily disappear immediately from the directory. When an incorporated firm closes down, the owner will no longer have use for the firm's telephone subscription. Thus, the name of that particular firm will disappear from subsequent issues of the directory. However, this does not always hold true for sole proprietors. If they go bankrupt, the liquidation process may involve the immediate sale of the telephone subscription. If the firm closes down for other reasons, however, particularly in cases in which the owners' workplaces are not separate from their homes, they will maintain the telephone subscription and the name of the firm will remain in the directory. This pattern would apply especially to the 25 percent of sole proprietors who register their personal names in the directory.

Another major problem is that the business classification system of the telephone directory changed after 1986. Business fields as well as their order in the issues we used to identify the survived firms are quite different from those in the issues we used to identify the start-up firms.

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[31] We use the June 1986, October 1987, and November 1989 issues to verify the survival of cohorts 1, 2, and 3, respectively. The reason for focusing on the survival of the first 5 years (rather than a shorter or longer period) is that we know both anecdotally and empirically that the first 5 years are crucial for start-up firms. According to an analysis by the Small and Medium Enterprise Agency (*Chusho Kigyo Hakusho 2002*), the ratio of business failures of manufacturing start-ups is considerably higher at the beginning, but stabilizes after the fourth or fifth year. Hisakazu Matsushige reports that two-thirds of his sample firms experienced "the hardest time" within 5 years of existence; see Hisakazu Matsushige, "Kigyogo no seicho wo ketteisuru yoin" [Determinants of Growth of the Start-up Firms], in *Maikro bijinesu no keizai bunseki* [The Economic Analysis of Micro-Businesses], ed. Naoki Mitani and Akira Wakisaka (Tokyo, 2002), 3-19.

TABLE 2
Start-Up and Survival Ratio in the Top 10 Business Fields, Based on Number of Start-Ups

Ranking	Business Field	Incumbents	Start-Up Firms	Start-Up Ratio	Survived Firms	Survival Ratio
1	Machinery industry	1,615	215	**0.133**	156	**0.726**
2	Electric equipment	908	141	**0.155**	81	0.574
3	Sheet metal processing	1,529	122	0.080	83	**0.680**
4	Dyes and moulds	385	88	**0.229**	65	**0.739**
5	Machine tools	414	76	**0.184**	52	**0.684**
6	Printing	453	75	**0.166**	51	**0.680**
7	Plastic products	586	72	**0.123**	47	0.653
8	Precision instruments	277	59	**0.213**	41	**0.695**
9	Tool-making	548	55	0.100	33	0.600
10	Metalworking	239	45	**0.188**	31	**0.689**
	Top 5	4,851	642	**0.132**	437	**0.681**
	Top 10	6,954	948	**0.136**	640	**0.675**
Manufacturing Total		14,740	1,603	0.109	1,057	0.659

Notes: Incumbents are firms listed in the telephone directory at the beginning of the first period (June 1980). Numbers in boldface are higher than the average for the manufacturing sector.

Prior to 1984, directories included both business-to-business and business-to-customer sections, with business fields organized according to industry classification in each section. Since 1986, when the directory integrated the two sections, they reorganized and differentiated business fields and placed them in alphabetical order. Because it was not always easy to follow the modified business classification and order, our identification of the survived firms might be incomplete.[32]

Moreover, a start-up firm may change its name, address, or business field. It is difficult to track firms when they change both their names and addresses or their names and business fields, particularly when they move outside the twenty-three wards. We cannot distinguish such firms from business failures or closures and therefore place them in the latter category. Thus, in this respect too, data on firm survival obtained from the telephone directory are imperfect, and the survival ratio may be underestimated. We identified sixteen cases of relocation to the other wards in Tokyo; however, in this essay, we categorized them as "not survived." This is partly for simplicity, but also because we are interested in the effect of agglomeration on survival in the same location.

Even if the start-up firms change their addresses or business fields, we can find them in another type of telephone directory, "Hellopage," in which personal and company names are listed in alphabetical order, so long as they are located in one of the twenty-three wards of Tokyo. We found approximately 17 percent of the start-up firms, incorporated and others, that seemed to have disappeared from the business telephone directory (partly because the classification and the order of business fields changed substantially after 1986) "alive" in the "Hellopage."

A major limitation of our analysis is that we are unable to distinguish real business closures from "missing" cases resulting from relocation, change of name, and other reasons. For the purpose of empirical analysis, we assume that the probability of a new firm changing its name or business field is independent of the firm and industry characteristics, including the extent of industry agglomeration.

However, this may be too strong an assumption concerning address changes, as firms may have left Ota because of environmental problems with neighboring residents, increasing real estate prices, or space limitations, which would depend on firm size and industry characteristics. Indeed, several contemporary reports on the manufacturing industry in Ota testify to a wave of manufacturing plants moving away from Ota, which even local government policy supported.[33] Therefore, in our empirical analysis, we control for this "moving-out effect" through the

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[32] The telephone directory provided no detailed information on the relation between the old and new classifications.

[33] See, for example, Seki and Kato, *Gendai nihon no chusho kikai kogyo*. The fact that the total number of manufacturing plants in Ota did not decrease during the observation period suggests that we are mainly analyzing new firms' survival rather than their relocation.

variables of firm size and location in Ota to help mitigate the noise from these limitations.

With these constraints, we eventually confirmed 1,057 "survivors" among 1,603 start-up firms in three cohorts. The average survival ratio of the pooled sample after approximately five years is 66 percent (see Table 1).

The interval between issues of the directory decreased during the latter half of the 1980s from approximately 1.5 to one year; there is an irregular interval of approximately 16 months between the June 1986 and October 1987 issues. This implies that survivors' average firm age in each cohort differs with the time their survival is checked.

For example, the surviving start-up firms in the first cohort were founded between June 1980 and November 1981 and survived at least until June 1986, when they were between 4.5 and 6 years old (5 years, 3 months, on average). Similarly, we can calculate the average firm age of the surviving start-up firms for the second cohort (5 years, one month) and the third cohort (5 years, 8 months). Adjusting these average firm ages to five years, we estimate that the adjusted average survival ratio of the total sample is 70 percent, while those of each cohort are 74, 60, and 77 percent, respectively.

In Table 3, we show the number and ratio of start-up firms and survived firms by 2-digit SIC (Standard Industry Classification) number. Here, the telephone directory business classification was reorganized and aggregated to the 2-digit SIC. It is noteworthy that the survival ratio is relatively high in the metal products and the general machinery industries, in which the majority of manufacturing firms in Ota are concentrated.

Empirical Model and Hypotheses

Drawing from previous studies, we use the following basic model for the empirical analysis:

> Probability of survival = f (level of industry agglomeration, legal form, firm size, start-up period, location)

In this simple model, the dependent variable is a dummy variable (SURVIVE) with a value one if the firm survives five years after start-up, and zero otherwise. Although recent empirical researchers estimate proportional hazards models, we estimate probit models.[34] Our data source is not conducive to the estimation of hazards models because of the

[34] See David B. Audretsch and Tarat Mahmood, "New Firm Survival: New Results Using a Hazard Function," *Review of Economics and Statistics* 77 (Feb. 1995): 97-103; Honjo, "Business Failure of New Software Firms" and "Business failure of new firms"; Fotopoulos and Louri, "Location and Survival of New Entry."

TABLE 3
Start-Up and Survival Ratio According to Industry Classification

Industry Classification	Incumbents	Start-Up Firms	Start-Up Ratio	Survived Firms	Survival Ratio
Food and beverages	113	29	**0.257**	15	0.517
Textile and clothing	146	5	0.034	4	**0.800**
Lumber/furniture/paper	364	21	0.058	16	**0.762**
Printing and publishing	578	93	**0.161**	63	**0.677**
Chemical products	243	16	0.066	10	0.625
Plastic products	586	72	**0.123**	47	0.653
Rubber products	114	9	0.079	6	**0.667**
Ceramic/stone/clay	554	46	0.083	23	0.500
Iron and steel	596	40	0.067	28	**0.700**
Nonferrous metals	214	22	0.103	18	**0.818**
Metal products	3,737	320	0.086	225	**0.703**
General machinery	4,326	588	**0.136**	400	**0.680**
Electric machinery	1,947	226	**0.116**	130	0.575
Transportation equipment	664	36	0.054	16	0.444
Precision instruments	553	78	**0.141**	54	**0.692**
Miscellaneous industries [a]	5	2	**0.400**	2	**1.000**
Manufacturing Total	14,740	1,603	0.109	1,057	0.659

Notes: Incumbents are firms listed in the telephone directory at the beginning of the first period (June 1980).
Numbers in boldface are higher than the average for the manufacturing sector.
[a] lacquer ware

irregular intervals in the observation periods and the possible discontinuity in measuring survival resulting from the substantial change of the business field classification in the directory after 1986.

The primary independent variable is the level of industry agglomeration, which is measured in three ways: the number of firms in the same business classification (according to the telephone directory before 1985) in Ota at the beginning of each cohort (AGGLOM1); the number of firms in the same 2-digit industry in Ota at the beginning of each cohort (AGGLOM2); and the extent of the relative concentration of firms of a 2-digit industry in Ota, obtained by dividing AGGLOM2 by the number of firms in the same 2-digit industry in Japan, in 1981 (AGGLOM3).[35] AGGLOM1 and AGGLOM2 measure the absolute level of agglomeration, while AGGLOM3 indicates the relative level of agglomeration. The difference between the first two variables is the range of related industries that promote agglomeration effects. Moreover, as an alternative to the variables of agglomeration, we use 2-digit SIC industry dummies to control for industry-specific factors.

We can characterize the manufacturing industries in Ota by the agglomeration of a multitude of small firms in a relatively narrow area, their "flexible specialization" in various processes of the metal and machinery industries, and intensive horizontal linkages among these small firms. We expect such an environment to support the survival and development of start-up firms in the agglomerated industries. In this sense, the absolute level of agglomeration matters more than the relative level. Moreover, by comparing the effects of two measures of the absolute level of agglomeration (AGGLOM1 and AGGLOM2), we can determine if the agglomeration effect depends more on the number of incumbents in related fields than on those in the same specialized field of production or processing.

Previous researchers have used both absolute and relative levels of agglomeration as variables, though the latter appears to be dominant. Yuji Honjo, for example, has used the logarithm of the number of establishments in the software industry in each prefecture as the measure of the absolute level of agglomeration, as well as the percent of employees in an industry in Tokyo compared to that in the entire country as the measure of the relative level of agglomeration (on which our variable AGGLOM3 relies)[36].

Another important independent variable is the legal form of the new firm. We use dummy variables for the joint-stock company (STOCK) and the limited company (LIMIT), to be compared with the sole proprietor (SOLE) as the reference.

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[35] We use only the data from 1981 as the denominator in calculating AGGLOM2, and not the data at the beginning of each cohort because the Establishment and Enterprise Census gathered data during the 1980s only in 1981 and 1986. To calculate the AGGLOM3 variable, the telephone directory business fields were grouped by the 2-digit SIC industry.

[36] See Honjo, "Business Failure of New Software Firms" and "Business failure of new firms."

The telephone directory lists joint-stock companies and limited companies as such, but this practice does not necessarily mean that all other firms are unincorporated.[37] Registration under a personal name suggests that the firm is not incorporated, but it is possible for a registered factory name to be incorporated, but not included in the directory. However, considering that the majority (53 percent) of small businesses in the manufacturing sector in Japan are unincorporated, according to the 2001 Establishment and Enterprise Census, we assume that the share of the sole proprietors in our sample (41 percent) is not overestimated.

In previous studies, some researchers have reported that, other things being equal, incorporated firms are more likely to survive than sole proprietors are.[38] There are some reasons why incorporated companies, particularly joint stock companies, have better chances of survival. First, incorporating a firm requires substantial funds; with more funds, incorporated firms are consequently less vulnerable. Second, incorporation is an important sign of trustworthiness for business partners, banks, and investors, whose support aids firms' survival. Third, incorporation requires numerous detailed documents and lengthy and complex procedures, as well as a registration fee. All these requirements are sunk costs that act as barriers to exit. In addition, they may reflect self-selection on the part of the entrepreneurs, such that entrepreneurs who start up firms as incorporated businesses have a greater potential to survive and develop.

Further, we use a dummy variable (SWITCH), assigned a value of one if the firm registers a switchboard number in the directory and zero otherwise. We consider this variable to be a proxy for firm size, because the registration of a switchboard number indicates that the firm has several extensions, suggesting that there are several persons in charge of different tasks. Previous researchers report that larger firms are more likely to survive because they have more business resources and, consequently, are less vulnerable.[39] Among our sample firms, those with a registered switchboard number account for approximately 25 percent.

We controlled for the effects of industry agglomeration, legal form, and size of start-up firms by the start-up period and the location within the ward. Specifically, we controlled for the effect of different start-up periods by using the cohort dummies: COHORT1 (June 1980 to November 1981), COHORT2 (December 1981 to May 1983), and COHORT3 (June 1983 to November 1984). Among these, we use COHORT1 as the reference.

In terms of firm location, we classified the ward into five areas, relying on Mitsuhiro Seki and Hideo Kato's *Gendai nihon no chusho kikai kogyo*:

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[37] In Japan, there are four types of legal forms of corporations, but almost all incorporated firms are either joint stock companies or limited companies.

[38] See, for example, David Harhoff, Konrad Stahl, and Michael Woywode, "Legal Form, Growth and Exit of West German Firms—Empirical Results for Manufacturing, Construction, Trade and Service Industries," *Journal of Industrial Economics* 46 (Dec. 1998): 453-88.

[39] See the summary in Storey, *Understanding the Small Business Sector*.

AREA1 (uptown), AREA2 (riverside), AREA3 (inland), AREA4 (seaside) and AREA5 (reclaimed islands). The density of factories is particularly high in the seaside and riverside areas, while residential and park spaces are interspersed with factories in the uptown and inland areas. Reclaimed islands are designated as factory spaces so that the firms cause no environmental problems for their neighbors. These different area characteristics may affect relocation, rather than failure, of start-up firms. We expected that using these location dummies would mitigate the problem of distinguishing real business failures from relocation.

We summarize definitions of the variables discussed in this section in Table 4, and provide sample statistics in Table 5. The average survival ratio for five years is 66 percent. With regard to the level of agglomeration, start-up firms had an average of nearly 600 incumbent firms in the same business field and nearly 2,600 incumbents in the same 2-digit SIC industry in Ota when they began operation. On average, 4 percent of the business establishments in a 2-digit SIC industry in Japan are concentrated in Ota. Incorporated firms make up 60 percent of the start-up firms; two-thirds are joint-stock companies. About 25 percent of the new firms registered a switchboard number. We did not find substantial differences among the cohorts with regard to the number of start-up firms. With respect to location, the inland area has the largest concentration of new firms (30 percent), followed by the uptown area. Only 2 percent of new firms are located in the reclaimed islands.

Using these variables, we specify four probit models. We formulated the first as:

$$\{P \mid SURVIVE\} = f(AGGLOM1, STOCK, LIMIT, SWITCH, COHORT2, COHORT3, AREA1, AREA2, AREA3, AREA4)$$

All four models have the same specification, except for the variables of agglomeration, such that models 2 and 3 used AGGLOM2, and AGGLOM3, respectively, rather than AGGLOM1. Model 4 includes 2-digit industry dummies instead of an agglomeration variable.

We empirically tested three hypotheses:

Hypothesis 1

The level of industry agglomeration positively affects the survival of new firms; start-up firms coexisting with a larger number of firms in the same or related industries are more likely to survive the first five years than those coexisting with a smaller number of firms (thus, we expect the coefficients of AGGLOM1, AGGLOM2, and AGGLOM3 to be positive).

TABLE 4
Definition of Variables

SURVIVE	Survived 5 years after start-up = 1, otherwise 0
AGGLOM1	Number of incumbents in Ota in the same business field (telephone directory business classification) in the directory at the beginning of each cohort
AGGLOM2	Number of incumbents in Ota in the same 2-digit industry (Standard Industry Classification) in the directory at the beginning of each cohort
AGGLOM3	Relative agglomeration ratio（AGGLOM2/number of business establishments in the same industry in Japan in 1981 * 100）
SOLE	Founded as a sole proprietorship = 1, otherwise 0 (reference)
LIMIT	Founded as a limited company = 1, otherwise 0
STOCK	Founded as a joint stock company = 1, otherwise 0
SWITCH	Registering a switchboard number = 1, otherwise 0
COHORT1	Founded in the period June 1980-Nov. 1981 = 1, otherwise 0 (reference)
COHORT2	Founded in the period Dec. 1981-May 1983 = 1, otherwise 0
COHORT3	Founded in the period June 1983-Nov. 1984 = 1, otherwise 0
AREA1	Founded in the Uptown Area = 1, otherwise 0
AREA2	Founded in the Riverside Area = 1, otherwise 0
AREA3	Founded in the Inland Area = 1, otherwise 0
AREA4	Founded in the Seaside Area = 1, otherwise 0
AREA5	Founded on the Reclaimed Islands = 1, otherwise 0 (reference)

Hypothesis 2

The legal forms of the start-up firms affect the probability of their survival; incorporated firms are more likely to survive the first five years than are the sole proprietors (thus, we expect the coefficients of STOCK and LIMIT to be positive).

Hypothesis 3

The initial size of the start-up firms positively influences their survival chance; firms with a switchboard registration are more likely to survive the first five years than others (thus, we expect the coefficients of SWITCH to be positive).

Empirical Results and Discussion

We present the results of the empirical analysis for the entire sample in Table 6. Models 1, 2, and 3 display the effects of different measures of industry agglomeration. Only model 4 includes industry dummies to control for inter-industry differences in firm survival.

TABLE 5
Sample Statistics

Variables	Mean	Standard Deviation	Minimum	Maximum
SURVIVE	0.66	0.47	0	1
AGGLOM1	598	566	2	1,633
AGGLOM2	2,596	1,512	113	4,281
AGGLOM3	3.97	1.51	0.07	6.59
SOLE	0.41	0.49	0	1
LIMIT	0.19	0.39	0	1
STOCK	0.40	0.49	0	1
SWITCH	0.25	0.43	0	1
COHORT1	0.32	0.47	0	1
COHORT2	0.33	0.47	0	1
COHORT3	0.35	0.48	0	1
AREA1	0.27	0.44	0	1
AREA2	0.19	0.39	0	1
AREA3	0.30	0.46	0	1
AREA4	0.22	0.42	0	1
AREA5	0.02	0.15	0	1

Note: We used SOLE, COHORT1, and AREA5 as references.

With regard to the effect of industry agglomeration, we found no support for our hypothesis. The estimated coefficients of AGGLOM1, AGGLOM2, and AGGLOM3, although positive, do not indicate that the level of agglomeration affects the survival of start-up firms.

Contrary to our expectation, STOCK had a negative coefficient, statistically significant (p = .01) for all models. LIMIT had no significant effect. Thus, joint-stock companies had a higher probability of failure compared to the sole proprietors. This result is robust and remains highly significant even after removing SWITCH from the models.

A possible explanation for this result is that STOCK represents the effect of firm size. Relatively larger firms relocated to the suburbs of Tokyo or to local districts in the 1980s because of high input prices, congestion (no space for expansion), and environmental problems with new inhabitants in the neighborhood. Thus, the negative effect of STOCK may suggest that larger firms (joint-stock companies), rather than being more likely to fail, are more likely to move out of Ota Ward than are smaller firms (sole proprietors). Another possibility is that sole proprietors tend to maintain their phone subscriptions and remain alive in the directory even after firm closure.

TABLE 6
Regression Results for the Entire Sample (n = 1,603)
PROBIT, dependent variable = SURVIVE

Variables	1		2		3		4	
Constant	1.24	(4.75)[a]	1.18	(4.36)[a]	1.20	(4.39)	0.97	(2.79)[a]
AGGLOM1	0.61E-04	(1.02)						
AGGLOM2			0.33E-04	(1.50)				
AGGLOM3					0.19	(0.88)		
COHORT2	-0.30	(-3.74)[a]	-0.31	(-3.78)[a]	-0.30	(-3.76)[a]	-0.32	(-3.96)[a]
COHORT3	-0.077	(-0.95)	-0.077	(-0.95)	-0.076	(-0.94)	-0.087	(-1.06)
STOCK	-0.31	(-3.80)[a]	-0.31	(-3.77)[a]	-0.32	(-3.96)[a]	-0.27	(-3.29)[a]
LIMIT	-0.11	(-1.23)	-0.11	(-1.14)	-0.11	(-1.17)	-0.09	(-0.99)
SWITCH	0.16	(1.91)[c]	0.16	(1.92)[c]	0.16	(1.90)[c]	0.16	(1.88)[c]
AREA1	-0.66	(-2.59)[a]	-0.65	(-2.52)[b]	-0.66	(-2.58)[a]	-0.59	(-2.26)[b]
AREA2	-0.67	(-2.56)[a]	-0.65	(-2.47)[b]	-0.67	(-2.56)[b]	-0.60	(-2.27)[b]
AREA3	-0.69	(-2.68)[a]	-0.67	(-2.62)[a]	-0.68	(-2.67)[a]	-0.62	(-2.39)[b]
AREA4	-0.54	(-2.07)[b]	-0.52	(-2.01)[b]	-0.53	(-2.03)	-0.47	(-1.77)[c]
Industry Dummy	No		No		No		Yes	
Pseudo R-square	0.028		0.029		0.028		0.040	
Log likelihood	-1,006		-1,005		-1,005		-995.5	
Observations	1,603		1,601		1,601		1,603	

Notes: t-statistics in parentheses.
[a]Significant at $p = .01$.
[b]Significant at $p = .05$.
[c]Significant at $p = .10$.

Hypothesis 3, that larger firms are more likely to survive, is supported by the finding that the coefficient of SWITCH is positive and significant (at p = .10) in all models. The probability of survival of firms registering a switchboard number is higher than that of firms that do not.

The results also suggest that the time of start-up matters: New firms founded in the second period (December 1981 to May 1983) are significantly less likely to survive than those founded in the first period (June 1980 to November 1981).

The location of the start-up firms also matters: As compared to the reclaimed islands (AREA5), location in any other area in Ota has a negative and significant effect on firm survival. We can also interpret this result, however, to imply that several supposed start-up firms on the reclaimed islands are existing firms that moved there from elsewhere, or are the subsidiaries of existing firms. If so, they were not start-ups.

The unexpected negative and significant coefficients of STOCK may suggest that the "exits" of sole proprietors and incorporated firms, particularly joint-stock companies, have different characteristics. For example, the apparent exits of the joint-stock companies may include a substantial number of relocations from Ota. Maintaining telephone subscriptions under personal names even after the exit may partly conceal actual exits of sole proprietors. Therefore, we estimated the same models using sub-samples of the sole proprietors and the joint-stock companies.

In Table 7, we present the estimation results for the sole proprietors. We excluded one of the location variables, AREA4, from the models, because only two firms were located in that area. Among the independent variables, only COHORT2 has significant coefficients. Accordingly, the explanatory power of the models is low.

In Table 8, we present the results of the joint-stock companies. They are in stark contrast to the results in Table 7. In Table 8, all independent variables except for AGGLOM1 and COHORT3 have a significant coefficient. Accordingly, the explanatory power of the models is higher than the estimations in Tables 6 and 7, and they support our hypothesis concerning the effect of industry agglomeration.

TABLE 7
Regression Results for Sole Proprietors (n = 663)
PROBIT, dependent variable = SURVIVE

Variables	**1**		**2**		**3**		**4**	
Constant	0.66	(4.59)[a]	0.74	(4.41)[a]	0.83	(4.38) [a]	1.03	(3.28)[a]
AGGLOM1	0.12E-03	(1.35)						
AGGLOM2			0.57E-05	(0.16)				
AGGLOM3					-0.017	(-0.50)		
COHORT2	-0.39	(-3.11)[a]	-0.39	(-3.10)[a]	-0.38	(-3.07)[a]	-0.36	(-2.86)[a]
COHORT3	-0.06	(-0.46)	-0.07	(-0.521)	-0.071	(-0.54)	-0.06	(-0.44)
SWITCH	-0.07	(-0.32)	-0.08	(-0.357)	-0.08	(-0.36)	-0.07	(-0.29)
AREA1	0.03	(0.18)	-0.01	(-0.07)	-0.03	(-0.18)	0.04	(0.23)
AREA2	-0.20	(-1.27)	-0.22	(-1.43)	-0.22	(-1.47)	-0.17	(-1.10)
AREA3	-0.05	(-0.39)	-0.08	(-0.57)	-0.08	(-0.64)	-0.070	(-0.49)
Industry dummies	No		No		No		Yes	
Pseudo R-square	0.024		0.020		0.021		0.036	
Log likelihood	-395.8		-396.7		-396.6		-391.5	
Observations	663		663		663		663	

Notes: We excluded the variable AREA4 from the estimation as it applies to only two cases.
t-statistics in parentheses.
[a]Significant at p = .01.

TABLE 8
Regression Results for Joint-Stock Companies (n = 636)
PROBIT, dependent variable = SURVIVE

Variables	**1**		**2**		**3**		**4**	
Constant	1.21	(3.61)[a]	1.02	(2.98)[a]	0.95	(2.67)[a]	0.54	(1.09)
AGGLOM1	0.130E-03	(1.23)						
AGGLOM2			0.883E-04	(2.49) [b]				
AGGLOM3					0.07	(2.12) [b]		
COHORT2	-0.25	(-1.96)[a]	-0.28	(-2.17)[b]	-0.26	(-2.01)[b]	-0.30	(-2.25)[b]
COHORT3	-0.08	(-0.63)	-0.09	(-0.71)	-0.78	(-0.61)	-0.10	(-0.717)
SWITCH	0.20	(1.93)[c]	0.19	(1.87)[c]	0.19	(1.82)[c]	0.16	(1.47)
AREA1	-1.06	(-3.22)[a]	-1.02	(-3.08) [a]	-1.03	(-3.17) [a]	-0.95	(-2.80)[a]
AREA2	-1.02	(-2.99)[a]	-0.94	(-2.74)[a]	-0.99	(-2.93)[a]	-0.90	(-2.54)[b]
AREA3	-1.04	(-3.13)[a]	-0.98	(-2.96)[a]	-1.00	(-3.07)[a]	-0.95	(-2.79)[a]
AREA4	-0.77	(-2.20)[b]	-0.72	(-2.05)[b]	-0.73	(-2.11)[b]	-0.67	(-1.86)[c]
Industry dummies	No		No		No		Yes	
Pseudo R-square	0.037		0.044		0.044		0.080	
Log likelihood	-412.6		-409.0		-409.8		-398.7	
Observations	636		634		634		636	

Notes: t-statistics in parentheses.
[a]Significant at $p = .01$.
[b]Significant at $p = .05$.
[c] Significant at $p = .10$.

While the level of agglomeration in the more narrowly defined business field (AGGLOM1) does not affect the survival of new firms significantly, even though the sign of the coefficient is positive as expected, the level of the absolute and relative agglomeration in the 2-digit SIC industry (AGGLOM2 and AGGLOM3) both positively and significantly impacts survival.

These findings suggest that the probability of survival of the start-up firms (in the form of joint-stock companies) increases with the agglomeration of existing firms in the same industry. The different impact of AGGLOM1 and AGGLOM2 reveals that the agglomeration of existing firms in a wider range of related industries (2-digit) is more important than the agglomeration in a narrower field corresponding to the business classification of the directory.

In this regard, our results are contrary to those of Yuji Honjo, who reported a negative and significant effect of agglomeration on the survival of start-up firms[40]. The reason for this contrast is unclear, but it may result from the differences in the samples and estimation methods (probit model rather than proportional hazards model).

With regard to the other variables, we obtained results similar to those in Table 6: SWITCH has a positive and significant effect on survival, the coefficients of COHORT2 have negative and significant signs, and all location dummies have negative and significant effects. Summing up our empirical results, we found support for our main hypothesis about the positive effect of industry agglomeration on the survival of start-up firms only from the sub-sample of joint-stock companies.

Conclusions

In this essay, we examined the positive effect of industry agglomeration on the survival of new firms, using a unique dataset constructed from the business telephone directory of Tokyo and focusing on the manufacturing firms in Ota Ward in the first half of the 1980s. During this period, the largest agglomeration of metal and machinery industries in Japan reached its peak.

There is still little empirical evidence concerning the impact of industry agglomeration on the survival of start-up firms. One of the important advantages of using the telephone directory as the data source for empirical studies is that it is more comprehensive than the other data sources on which previous researchers relied. We have contributed a unique dataset for empirical analyses and a focus on the effect of industry agglomeration on the survival of new firms.

Based on the business telephone directory, we identified 1,603 start-up firms in the manufacturing sector in Ota in the period from June 1980 to December 1984. We estimated the annual average start-up ratio in this

[40] See Honjo, "Business Failure of New Software Firms" and "Business failure of new firms."

period to be approximately 2.4 percent. From among these new firms, 66 percent survived the first five years and remained in Ota.

The results of the empirical analysis partially support our hypotheses. We found support for the positive effect of industry agglomeration only from the joint-stock companies: Start-up firms coexisting with a larger number of firms in the same 2-digit industry are more likely to survive the first five years. Contrary to our hypothesis, the joint-stock companies show a significantly lower survival probability. The registration of a switchboard number, a proxy for firm size, shows the expected positive and significant impact on survival. The low overall explanatory power of the estimations suggests that we have not considered some important determinants.

Moreover, our research has some restrictions. A major problem with the telephone directory as a data source is that we cannot distinguish business failures and closures from relocations and changes of name and/or business field of the firms, despite several efforts to track them. This implies that we may underestimate firm survival in our research. In addition, we cannot exclude the possibility that our sample of "start-up" firms includes existing firms that relocated to Ota Ward from outside Tokyo's twenty-three wards during the focus period or those that changed names or business fields. Thus, we may have overestimated the number of start-up firms.

The relocation of firms out of Tokyo evokes another restriction. We implicitly assumed that the probability of relocation is independent of the firm and industry characteristics. However, if the relocation of firms out of Tokyo occurs primarily for reasons such as limited scope of expansion or environmental problems with neighboring inhabitants, the probability of relocation may be associated with firm size (or legal form) and business fields. Thus, we can explain the unexpected result that incorporated firms are significantly less likely to survive by surmising that the incorporated firms (which are relatively large) may be more likely to survive, but are much more likely to relocate because of their success.

Business historians tend to be interested in large firms and have paid little attention to the development of small start-up firms in the local context. Through our atypical approach, our study contributes to a better understanding of the influence of industry agglomeration on the development of new firms.

Appendix
Correlation Matrices
1. Entire sample (n = 1,603)

Variables	SURVIVE	COHORT1	COHORT2	COHORT3	AGGLOM1	AGGLOM2	AGGLOM3	STOCK	LIMIT	SOLE	SWITCH
SURVIVE	1.00										
COHORT1	0.07	1.00									
COHORT2	-0.09	-0.48	1.00								
COHORT3	0.02	-0.50	-0.51	1.00							
AGGLOM1	0.04	0.00	0.02	-0.02	1.00						
AGGLOM2	0.06	-0.01	0.03	-0.02	0.37	1.00					
AGGLOM3	0.03	-0.02	0.03	-0.01	0.28	0.62	1.00				
STOCK	-0.08	-0.02	0.00	0.02	-0.15	-0.12	0.03	1.00			
LIMIT	0.01	-0.06	0.02	0.04	0.06	0.00	-0.05	-0.39	1.00		
SOLE	0.08	0.07	-0.02	-0.05	0.10	0.12	0.01	-0.68	-0.41	1.00	
SWITCH	0.01	-0.01	0.01	0.00	-0.10	-0.05	0.03	0.41	-0.05	-0.37	1.00

2. Sole proprietors (n = 663)

Variables	SURVIVE	COHORT1	COHORT2	COHORT3	AGGLOM1	AGGLOM2	AGGLOM3	SWITCH
SURVIVE	1.00							
COHORT1	0.08	1.00						
COHORT2	-0.13	-0.51	1.00					
COHORT3	0.04	-0.52	-0.47	1.00				
AGGLOM1	0.05	0.02	0.03	-0.04	1.00			
AGGLOM2	0.01	0.03	-0.01	-0.02	0.37	1.00		
AGGLOM3	-0.03	-0.01	0.07	-0.07	0.32	0.63	1.00	
SWITCH	-0.02	0.04	0.02	-0.05	-0.04	-0.02	-0.01	1.00

3. Joint stock companies (n = 636)

Variables	SURVIVE	COHORT1	COHORT2	COHORT3	AGGLOM1	AGGLOM2	AGGLOM3	SWITCH
SURVIVE	1.00							
COHORT1	0.06	1.00						
COHORT2	-0.07	-0.47	1.00					
COHORT3	0.02	-0.50	-0.52	1.00				
AGGLOM1	0.05	-0.05	-0.01	0.06	1.00			
AGGLOM2	0.11	-0.10	0.08	0.03	0.29	1.00		
AGGLOM3	0.09	-0.05	0.02	0.03	0.24	0.62	1.00	
SWITCH	0.09	0.03	0.01	-0.04	-0.05	0.05	0.07	1.00