SN Bus Econ (2021) 1:111
https://doi.org/10.1007/s43546-021-00117-x

ORIGINAL ARTICLE

Formal and informal support and the performance of new start-ups: a quantile regression analysis

Tomohiro Sakai[1] · **Mototsugu Fukushige**[2]

Received: 16 November 2020 / Accepted: 28 July 2021 / Published online: 29 August 2021
© The Author(s), under exclusive licence to Springer Nature Switzerland AG 2021

Abstract

Using survey data from the Japan Finance Corporation, we investigate whether formal or informal support contributes to the performance of new start-up enterprises. We apply ordinary least squares (OLS) and quantile regression to explain the achievement rate of monthly sales. The results of the OLS estimation suggest that formal support has negative effects on the achievement rate, whereas informal support has positive effects. From the results of the quantile regression analysis, the estimated coefficients by quantiles indicate that high-performing enterprises are not affected significantly by formal and informal supports in positive or negative directions, whereas low-performing enterprises are affected strongly in positive or negative directions. These results imply that encouraging the start-ups through formal/informal supports has negative/positive effects on achieving their expected performance. Although it is difficult to predict whether entrepreneurs will perform well before they start an enterprise, informal support has little effect on high-performing enterprises.

Keywords Start-up enterprises · Formal support · Informal support · Quantile regression

JEL Classification L25 · L53 · M13

✉ Mototsugu Fukushige
mfuku@econ.osaka-u.ac.jp

Tomohiro Sakai
1714922314@qq.com

[1] School of Foreign Studies, Northeastern University at Qinhuangdao, 143 Taishan Rd, Haigang District, Qinhuangdao 066004, Hebei, China

[2] Graduate School of Economics, Osaka University, 1-7, Machikaneyama-cho, Toyonaka, Osaka 560-0043, Japan

Introduction

New start-up enterprises can boost the economy by creating jobs, promoting innovation, and raising industrial competitiveness.[1] From a policy-maker's perspective, it is important to examine what kinds of factors encourage entrepreneurs to establish new enterprises. For example, Yasuda (2005) found that the utilization of policy-based finance helped increasing the finance of the practitioners' opening fund from private financial institution in Japan and Hazudin et al. (2015) focused that gender-based entrepreneurship policy and suggested that the program should consider the balance of work and family demand especially for female. By contrast, to maintain economic growth, it is important to not only increase the number of new start-ups, but also ensure their survival. Therefore, it is important to understand the factors that help new start-ups survive. Several previous studies have investigated this issue. For example, Bates (1990) found that education and entrepreneur age are important for enterprise longevity; Cressy (1996) estimated a survival function and found that the growth rate of cash flow, debt turnover, and firm type are important determinants of survival; Brüderl and Preisendörfer (1998) suggested the importance of support from enterprise networks; Sels and Vanhoutte (2006) investigated the relationships between profit, growth, and entrepreneur's experience and education levels using path analysis; and Gorman et al. (1997) examined the relationship between post-start-up conditions and entrepreneur's education level. Additionally, there also exist several empirical studies on start-ups in Japan. Imai and Kawagoe (2000) pointed out the small number of start-ups in the 1990s. Herrington (2017) showed that in 2017, Japan's total early-stage entrepreneurial activity (percentage of population aged 18–64 years who are either a nascent entrepreneur or owner–manager of a new business) was 4.68%. This is lower than in the US (13.64%) and the UK (8.40%), based on the Global Entrepreneurship Monitor (GEM), which was established in 1999 by Babson College (US), and the London Business School (UK), respectively, and the fifth-lowest of the 54 countries surveyed. Okamuro and Kobayashi (2006) investigated the differences in business opening rates among the regions of Japan and found the importance of the local accumulation of qualified human resources, while Honjo (2010) described new-enterprise support policies in Japan and found a positive relationship between the economic growth rate and opening rate of new start-ups from 1956 to 2007.

Two useful databases exist for empirical analyses of start-ups in Japan. The first is the Tokyo Shoko Research Database, which provides data on new start-ups. Honjo (2005), Yamada (2005), and Okamuro (2005) used this database of around 10,000 start-ups that were established between 1995 and 1999 and conducted a questionnaire survey (1141 valid responses). Their findings are as follows. Honjo (2005) investigated the effects of start-up type and entrepreneurs' age and education level

[1] There are many empirical studies. For example, Carree and Thurik (2010), Hartog et al. (2010), Bosma et al. (2018) and Sergi et al. (2019) surveyed macroeconomic relationships between entrepreneurship and economic growth. Most previous research has found positive impacts of new start-ups on economic growth.

on the sales growth rate, enterprise balance sheet, and entrepreneur happiness. He estimated negative and statistically significant coefficients for scale at commencement of operations and industry experience in the sales growth rate regression and positive and significant coefficients for the new start-ups being type of developing their family business both in the enterprise balance sheet and entrepreneur happiness regressions. Yamada (2005) investigated the characteristics of entrepreneurs and highlighted the importance of the roles of internal and external industry partners that complement the characteristics of entrepreneurs. Okamuro (2005) estimated a positive coefficient for advice and information provision from sales destinations in the regression for the growth rate of the number of employees. He also investigated the determinants of the advice and information provision from sales destinations using probit analysis and estimated positive coefficients for the dummy variables for securing sales channels by previous place of employment and by acquaintances or relatives.

The second is the Survey on State of New Business Start-ups, which is conducted annually among the enterprises financed by the National Life Finance Corporation and its successor, the Japan Finance Corporation. Suzuki (2007a, b) and Suzuki (2012) used these data. Suzuki (2007a) investigated the determinants of business failure, while Suzuki (2007b) investigated the achievement rate of expected monthly sales and identified the importance of the characteristics of the entrepreneurs, personal networks, and secured human resources. Suzuki (2012) investigated the growth rate of monthly sales and survival rate of newly established enterprises, finding a positive effect of support from sales destinations and former employers of the entrepreneurs.

In this paper, we investigate the effects of the utilization of formal and informal supports on the performance of new start-ups, using econometric analysis of the Japan Finance Corporation's survey data.[2] This type of approach is useful for identifying effective instruments with which to support newly established enterprises. As we mentioned above, some previous studies also investigated the effects of supports, e.g., Suzuki (2012) found a positive effect of support from sales destinations and former employers of the entrepreneurs. However, to our knowledge, no previous research has applied econometric analysis. In the present paper, we follow Suzuki (2007b) and adopt the achievement rate of expected monthly sales as the measure of the performance of newly established enterprises. This measure captures enterprises' expected performance before the commencement of operations, and we assume it is unaffected by the enterprise size directly. This is an important characteristic by which to measure the performance of newly established enterprises. For example, if

[2] There are several studies of social networks following Granovetter (1973) on weak ties, e.g., Durda and Ključnikov (2019) and Albourini et al. (2020), and on social capital, e.g., Liao and Welsch (2005) and Westlund et al. (2014). There are also several studies that stress the roles of business incubation on new start-ups, e.g., Al-Mubaraki and Busler (2013) and Scagnelli et al. (2019). In this paper, because of the limitations of the Japan Finance Corporation's survey data, we used this definition of formal and informal supports. Social network and social capital have similar relationships with informal support, and business incubation is included as an independent variable for formal support. A detailed definition of these supports is provided in "Summary of data and candidates for the independent variables".

the measure of performance was positively related to enterprise size, we would be unable to identify the effects of firm size. We conduct regression analyses focusing on the effects of formal and informal supports using start-up conditions, character of entrepreneurs, character of enterprise, and industrial categories as control variables. In addition to a simple regression approach to this problem, we adopt quantile regression. This method clarifies the relationships between relatively high- or low-performing enterprises and their performance. Of course, it is difficult to ascertain whether a start-up enterprise will perform well or poorly before it begins, but we can derive some additional empirical information on the relationships between performance and formal or informal support.

In "Summary of data and candidates for the independent variables", we describe the Japan Finance Corporation's survey data and identify possible independent variables for the regression analyses. In "Regression analyses", we apply ordinary least squares and quantile regression to investigate the differences in the effects of the several kinds of supports among high- and low-performing enterprises. Finally, in "Conclusion", we discuss the findings of the paper and some remaining issues for future research.

Summary of data and candidates for the independent variables

In this paper, we use data from the Survey on State of New Business Start-ups conducted in August 2015 and published by the Japan Finance Corporation Research Institute. The data were extracted from the SSJ Data Archive at the Institute of Social Science of the University of Tokyo (https://csrda.iss.u-tokyo.ac.jp/; Research No. 1082). The survey targeted 7917 enterprises and 1869 responses were collected. These enterprises were financed by the Japan Finance Corporation from April to September 2014. All enterprises received this financial support within 1 year of their establishment. This survey, which has been conducted annually since 1991, aims to ascertain the status of new business start-ups and targets new business owners who received loans from the Japan Finance Corporation.

As mentioned in "Introduction", we follow Suzuki (2007b) in adopting the achievement rate of expected monthly sales as the performance measure of newly established enterprises, and use this variable as the dependent variable in the regression analyses. This measure represents enterprises' expected performance before the commencement of business. These data are constructed by dividing current monthly sales by expected monthly sales before commencement. We use the logarithmic transformation of the dependent variable in the regression analyses; we denote this variable as AQ. In the analyses, we exclude enterprises with no monthly sales.

We use six types of independent variables: formal support, informal support, start-up conditions, characteristics of entrepreneurs, characteristics of enterprises, and dummy variables for industrial categories. We list all variables, including their denotations and explanations, in Table 1.

Table 1 Variable description

Variable	
Dependent variable	
AQ	Logarithmic transformed value of the rate of sales achievement quotient
Independent variables	
Formal support	
S_Seminar	Dummy variable for utilization of seminars or lectures on business
S_Information	Dummy variable for utilization of provision of information through corporate support site
S_Public	Dummy variable for utilization of low-interest loan by local government
S_Tax	Dummy variable for utilization of tax incentives
S_Incubate	Dummy variable for utilization of incubation facility
S_Senior	Dummy variable for utilization of exchange meeting with a senior manager
S_Exchange	Dummy variable for utilization of exchange meeting with entrepreneurs
S_Matching	Dummy variable for utilization of customer introduction by business matching or similar system
Informal support	
S_Family	Dummy variable for utilizing support from parents, spouse, children, or other relatives
S_Foermer	Dummy variable for utilizing support from the entrepreneur's former place of employment or its employees
S_Friend	Dummy variable for utilizing support from friends, acquaintances, or others
Start-up condition	
Lworkers	Logarithmic transformed number of workers when the enterprise started up
Characteristics of the entrepreneur	
Age	Age of entrepreneur when he/she started up the enterprise
AgeSQ	Square of age
Dfem	Dummy variable if the entrepreneur is female
Duniv	Dummy variable if the entrepreneur is a graduate from university or higher
Dexperi	Dummy variable if the entrepreneur has experience in the same industry
Dmanager	Dummy variable if the entrepreneur has experience as a manager in some enterprise
Characteristics of the enterprise	
Length	Time since commencement (in months)
LengthSQ	Square of time since commencement
LnLength	Logarithmic transformation of time since commencement
Dummy variable for the industry category	
Dconstr	Dummy variable for the construction industry

Table 1 (continued)

Variable	
Dinformation	Dummy variable for the information and communication industry
Dwholes	Dummy variable for the wholesales industry
Dfood	Dummy variable for the food or hotel industry
Dretail	Dummy variable for the retail industry
Dmed	Dummy variable for the medical or welfare industry
Dedu	Dummy variable for the education industry
Dservice	Dummy variable for the general service industry
Dother	Dummy variable if the industry is categorized as "other"

We remove the dummy variables for manufacturing, transportation, and real estate to avoid perfect multicollinearity or because of missing observations

First, we should discuss the definition of formal and informal supports.[3] Several studies have focused on the difference between informal and formal financial supports, e.g., Reynolds (2011), but we are unaware of any studies that have focused on a wide range of informal and formal supports. In this paper, we define formal and informal supports using responses from the Survey on State of New Business Startups. In this survey, there are two questions about the preparation and background for opening: one is about personal support—"Did you receive support from your family, people close to you, or your former employer when opening the business?"—and the other is about support measures—"Did you use support measures for opening a business?" We define the former type of support as informal support and the latter type as formal support in this paper. In other words, we consider informal support as support from individuals or organizations with whom prospective entrepreneurs have personal connections, and formal support as any kind of support that people who plan to start a new enterprise can avail, adopt, or participate in other than personal relationships.

For the independent formal support variables, we use eight dummy variables according to the type of formal support used by the entrepreneurs: seminars or lectures on business (S_Seminar), information provided by a corporate support site (S_Information), low-interest loans from the local government (S_Public), tax incentives (S_Tax), an incubation facility (S_Incubate), exchange meetings with senior managers (S_Senior), meetings with entrepreneurs (S_Exchange), and customer introduction through business matching or similar system (S_Matching). If an entrepreneur utilizes a form of formal support, the corresponding dummy variable equals one, and zero otherwise.

For the independent informal support variables, we construct three variables according to the support used by the entrepreneurs. In the survey, there are 80 (8×10) combinations of answers: eight categories of people from whom they received support (parents, spouse, children, other relatives, entrepreneur's former

[3] This paragraph reflects the comments of an anonymous referee.

employer or its employees, friends or acquaintances, other, and not received) and ten categories of the types of support the entrepreneurs used (1: guidance of technology or know-how, 2: transfer of machine or facility, rent of factory or store, 3: rental of stores or factories, 4: introduction of new sales destination or new orders placed by the entrepreneurs, 5: introduction to employees, 6: introduction to financial institutions, 7: providing start-up funds, 8: becoming a grantee of borrowing from financial institutions, 9: providing voluntary help in opening preparations and work, and 10: becoming a customer). We focus on whose support the entrepreneurs used and construct three dummy variables: support from parents, spouse, children, or other relatives (S_Family); entrepreneur's former place of employment or its employees (S_Foermer); and friends, acquaintances, or others (S_Friend). Although this type of variable was investigated by Brüderl and Preisendörfer (1998), we do not combine the source of support and support type. If an entrepreneur uses a form of informal support, the corresponding dummy variable equals one, and zero otherwise.

In addition, we use the logarithmic transformation of the number of workers employed (Lworkers) as an independent variable. This variable is a proxy for the size of the start-up enterprise at the commencement of business. Characteristics of the entrepreneurs and enterprises are important to control the characteristics of the start-ups: entrepreneur's age (Age and its squared value AgeSQ); gender (Dfem), equal to one if the entrepreneur is female, and zero otherwise; education level (Duniv), equal to one if the entrepreneur graduated from university or higher, and zero otherwise; experience in the same industries (Dexperi); and previous experience as a manager (Dmanager). The following papers motivated the inclusion of these variables. Bates (1990) focused on the roles of age and education level, Honjo (2005) on age and gender, Hazudin et al. (2015) on gender, Gorman et al. (1997) on education level, and Sels and Vanhoutte (2006) on education level and entrepreneurs' experiences as a manager or working in the same industry.[4] In addition, we adopt two types of variables as candidates for the independent variable. One is the length of time (in months) after start-up (Length and its squared value: LengthSQ and logarithmic transformed value: LnLength). This variable represents the process of achievement or maturity of the business. We also include a dummy variable for the differences among industries. There are nine industry dummy variables; we exclude the variable for manufacturing to avoid perfect multicollinearity. There are two other dummy variables, transportation and real estate, that we do not include as independent variables because they do not occur within our selected observations.

Summary statistics for the variables are shown in Table 2. This table summarizes 1605 observations from the 2015 Survey on State of New Business Start-ups because some observations among the original 1869 responses have unanswered items relevant to our investigation. According to Table 2, around 60% of the entrepreneurs used informal support, but fewer than 40% used some type of formal support. In particular, fewer than 10% used support from incubation facilities or matching systems. Before proceeding to the analyses, we consider the means and ranges

[4] Staniewski (2016) and Wise and Valliere (2014) also found effects of business experience on start-up performance.

Table 2 Summary statistics of variables

Variable	Obs	Mean	Std. dev.	Min	Max
Dependent variable					
AQ	1605	− 0.1407785	0.6336968	− 3.912023	3.149883
Independent variables					
Formal support					
S_Seminar	1605	0.3208723	0.4669573	0	1
S_Information	1605	0.2529595	0.4348434	0	1
S_Public	1605	0.2242991	0.4172499	0	1
S_Tax	1605	0.2099688	0.407413	0	1
S_Incubate	1605	0.0392523	0.1942552	0	1
S_Senior	1605	0.3856698	0.4869048	0	1
S_Exchange	1605	0.2728972	0.4455873	0	1
S_Matching	1605	0.0866044	0.2813421	0	1
Informal support					
S_Family	1605	0.6180685	0.4860113	0	1
S_Foermer	1605	0.5919003	0.491635	0	1
S_Friend	1605	0.6211838	0.4852434	0	1
Start-up condition					
Lworkers	1605	0.8781489	0.8336826	0	3.951244
Characteristics of the entrepreneur					
Age	1605	42.39128	9.790966	21	75
AgeSQ	1605	1892.824	889.5876	441	5625
Dfem	1605	0.164486	0.3708315	0	1
Duniv	1605	0.3663551	0.4819583	0	1
Dexperi	1605	0.8485981	0.3585519	0	1
Dmanager	1605	0.7133956	0.452316	0	1
Characteristics of enterprise					
Length	1605	14.57196	4.628933	1	28
LengthSQ	1605	233.7558	152.9142	1	784
LnLength	1605	2.625235	0.3462059	0	3.332205
Dummy variable for the industry category					
Dconstr	1605	0.0797508	0.2709914	0	1
Dinformation	1605	0.0404984	0.1971866	0	1
Dwholes	1605	0.0211838	0.1440416	0	1
Dfood	1605	0.0504673	0.2189754	0	1
Dretail	1605	0.117757	0.3224206	0	1
Dmed	1605	0.1626168	0.3691307	0	1
Dedu	1605	0.1993769	0.3996565	0	1
Dservice	1605	0.0267913	0.1615232	0	1
Dother	1605	0.2766355	0.4474741	0	1

Obs, mean, std. dev., min, and max indicate numbers of observations, means, standard deviations, minimum values, and maximum values of variables, respectively

of some of the logarithmically transformed variables. One is the achievement rate. The mean of AQ is − 0.14 and its range is from − 3.91 to 3.15. These values are approximately equal to 0.87 and from 0.02 to 28.3, respectively, in levels before the transformation.[5] For example, the mean of the achievement rate is approximately 87%. As for the values for Lworkers, 0.878 and 0–3.95 equal 2.40 and 1–52.0 in levels, respectively. The mean number of workers at the start is about 2.4, with a minimum of 1, which is the entrepreneur himself/herself and a maximum of 52 persons. Table 3 shows the correlation matrix of variables. There are no highly correlated variables except between the pairs of Length and its squared values (LengthSQ) and its logarithmic transformed values (LnLength).

Regression analyses

Ordinary least squares approach

As a first step, we conduct a regression analysis for the achievement rate of expected monthly sales with candidates for independent variables discussed in "Summary of data and candidates for the independent variables":

$$y_i = \beta_0 + x_i^{'}\beta_1 + \varepsilon_i,$$

where y_i is the dependent variable (the achievement rate of expected monthly sales), x_i is a column vector of the independent variables, β_0 is a regression coefficient as a constant term, β_1 is a column vector of the regression coefficient for the independent variables, and ε_i is an error term.

First, we estimate the regression equation by ordinary least squares. Table 4 shows the estimation results. We first estimate the full model, which includes all the candidate independent variables described in "Summary of data and candidates for the independent variables". The results show that most of the estimated coefficients are statistically insignificant. Then, we remove some variables to minimize the Akaike Information Criterion. This is the selected model in Table 4, which includes Lworkers, Age, Dexperi, LengthSQ, Dretail, Dmed, and Dedu as control variables. The estimated coefficients for Lworkers and LengthSQ are positive and statistically significant, which suggests that the achievement rate increases with enterprise size and time since opening the business. The estimated coefficient for Age is negative and that of Dexperi is positive. These results indicate that the achievement rate increases as entrepreneur's age decreases and as experience in the same industry increases. These results are similar to those of Bates (1990) and Sels and Vanhoutte (2006). The estimated coefficients for Dretail, Dmed, and Dedu are negative. These

[5] Generally speaking, there is a difference in mean or other statistics between original level and the logarithmic transformed variable, even if we rearrange the statistics for the logarithmically transformed data through reverse transformation.

Table 3 Correlation matrix of variables

	AQ	S_Seminar	S_Information	S_Public	S_Tax	S_Incubate	S_Senior	S_Exchange	S_Matching	S_Family
AQ	1.000									
S_Seminar	− 0.093	1.000								
S_Information	− 0.093	0.432	1.000							
S_Public	− 0.037	0.200	0.251	1.000						
S_Tax	− 0.004	0.219	0.277	0.412	1.000					
S_Incubate	− 0.065	0.177	0.192	0.261	0.219	1.000				
S_Senior	− 0.025	0.297	0.216	0.191	0.220	0.156	1.000			
S_Exchange	− 0.066	0.307	0.248	0.207	0.237	0.186	0.650	1.000		
S_Matching	− 0.042	0.187	0.234	0.243	0.276	0.360	0.261	0.363	1.000	
S_Family	0.037	0.117	0.050	0.054	0.018	− 0.026	0.101	0.067	0.023	1.000
S_Foermer	0.141	0.055	0.043	0.048	0.114	− 0.028	0.137	0.093	0.053	0.125
S_Friend	0.001	0.138	0.091	0.063	0.084	0.006	0.160	0.109	0.008	0.222
Lworkers	0.166	0.032	− 0.017	0.021	0.056	− 0.047	0.003	− 0.004	0.008	0.019
Age	− 0.164	− 0.032	− 0.048	− 0.024	− 0.019	− 0.012	− 0.159	− 0.126	− 0.025	− 0.196
AgeSQ	− 0.161	− 0.032	− 0.048	− 0.020	− 0.015	− 0.008	− 0.153	− 0.122	− 0.024	− 0.192
Dfem	− 0.072	0.033	0.086	0.011	− 0.018	− 0.003	− 0.006	− 0.004	− 0.047	0.093
Duniv	− 0.046	0.020	0.022	− 0.071	0.018	0.046	− 0.071	− 0.054	0.000	− 0.068
Dexperi	0.155	− 0.026	− 0.022	0.002	0.034	− 0.022	0.013	− 0.034	− 0.024	0.062
Dmanager	0.054	− 0.034	0.023	0.037	0.060	0.008	0.010	0.020	0.034	− 0.067
Length	0.053	− 0.065	− 0.024	0.026	0.069	0.057	− 0.002	0.010	0.066	− 0.108
LengthSQ	0.049	− 0.052	− 0.019	0.032	0.060	0.063	− 0.003	0.010	0.066	− 0.104
LnLength	0.052	− 0.072	− 0.025	0.020	0.074	0.043	0.004	0.010	0.060	− 0.095
Dconstr	0.073	− 0.084	− 0.076	0.002	0.006	− 0.048	− 0.040	− 0.031	− 0.001	− 0.086
Dinformation	− 0.012	− 0.019	− 0.003	− 0.012	− 0.013	0.024	− 0.026	− 0.005	0.060	− 0.008
Dwholes	0.025	− 0.064	− 0.056	− 0.017	− 0.012	− 0.008	0.008	− 0.022	− 0.030	− 0.107
Dfood	− 0.016	− 0.012	− 0.003	0.033	0.056	0.012	− 0.066	− 0.033	0.030	− 0.030

Table 3 (continued)

	AQ	S_Seminar	S_Information	S_Public	S_Tax	S_Incubate	S_Senior	S_Exchange	S_Matching	S_Family
Dretail	− 0.077	− 0.036	0.023	− 0.011	0.021	0.026	− 0.016	0.006	− 0.009	0.005
Dmed	− 0.029	0.015	− 0.039	0.030	− 0.032	− 0.028	− 0.065	− 0.039	− 0.010	0.114
Dedu	0.031	0.095	0.029	− 0.040	− 0.058	− 0.029	0.069	0.009	− 0.043	0.059
Dservice	− 0.035	0.002	0.010	0.003	− 0.029	− 0.034	− 0.044	− 0.024	0.018	0.003
Dother	0.019	0.028	0.047	0.008	0.030	0.033	0.082	0.071	− 0.007	− 0.016

	S_Family	S_Foermer	S_Friend	Lworkers	Age	AgeSQ	Dfem	Duniv	Dexperi	Dmanager
AQ										
S_Seminar										
S_Information										
S_Public										
S_Tax										
S_Incubate										
S_Senior										
S_Exchange										
S_Matching										
S_Family	1.000									
S_Foermer	0.125	1.000								
S_Friend	0.222	0.188	1.000							
Lworkers	0.019	0.009	0.010	1.000						
Age	− 0.196	− 0.191	− 0.116	0.047	1.000					
AgeSQ	− 0.192	− 0.193	− 0.112	0.048	0.991	1.000				
Dfem	0.093	− 0.083	0.083	− 0.047	0.079	0.081	1.000			
Duniv	− 0.068	− 0.050	− 0.137	0.044	0.092	0.088	− 0.132	1.000		
Dexperi	0.062	0.243	0.046	0.014	− 0.175	− 0.180	− 0.047	− 0.076	1.000	

Table 3 (continued)

	S_Family	S_Foermer	S_Friend	Lworkers	Age	AgeSQ	Dfem	Duniv	Dexperi	Dmanager
Dmanager	− 0.067	0.062	− 0.004	0.124	0.098	0.087	− 0.187	− 0.016	0.094	1.000
Length	− 0.108	− 0.024	− 0.096	− 0.024	0.100	0.097	− 0.075	0.052	0.006	0.026
LengthSQ	− 0.104	− 0.034	− 0.089	− 0.029	0.097	0.095	− 0.060	0.050	0.003	0.015
LnLength	− 0.095	− 0.003	− 0.080	− 0.013	0.091	0.086	− 0.096	0.045	0.007	0.032
Dconstr	− 0.086	0.006	− 0.069	− 0.094	0.028	0.020	− 0.112	− 0.109	0.092	0.014
Dinformation	− 0.008	0.010	− 0.048	− 0.035	0.055	0.052	− 0.006	0.001	0.043	− 0.003
Dwholes	− 0.107	− 0.036	− 0.072	− 0.060	0.095	0.095	− 0.065	− 0.040	− 0.010	− 0.041
Dfood	− 0.030	0.012	− 0.049	− 0.100	0.100	0.101	− 0.079	0.079	− 0.014	0.020
Dretail	0.005	0.012	0.030	− 0.022	0.010	0.005	0.026	0.011	− 0.018	− 0.008
Dmed	0.114	0.043	0.135	0.173	− 0.026	− 0.024	0.028	− 0.097	− 0.007	0.040
Dedu	0.059	− 0.058	0.049	0.270	− 0.043	− 0.036	0.031	0.054	− 0.037	− 0.036
Dservice	0.003	− 0.098	− 0.045	− 0.043	0.018	0.016	− 0.011	0.130	− 0.081	0.003
Dother	− 0.016	0.049	− 0.031	− 0.196	− 0.073	− 0.070	0.086	− 0.014	0.009	− 0.024

	Length	LengthSQ	LnLength	Dconstr	Dinformation	Dwholes	Dfood	Dretail	Dmed	Dedu	Dservice	Dother
Length	1.000											
LengthSQ	0.978	1.000										
LnLength	0.944	0.862	1.000									
Dconstr	0.088	0.075	0.088	1.000								
Dinformation	0.092	0.095	0.075	− 0.061	1.000							
Dwholes	0.070	0.070	0.064	− 0.043	− 0.030	1.000						
Dfood	0.102	0.094	0.097	− 0.068	− 0.047	− 0.034	1.000					
Dretail	0.008	0.017	0.001	− 0.108	− 0.075	− 0.054	− 0.084	1.000				
Dmed	− 0.156	− 0.151	− 0.134	− 0.130	− 0.091	− 0.065	− 0.102	− 0.161	1.000			
Dedu	− 0.078	− 0.069	− 0.080	− 0.147	− 0.103	− 0.073	− 0.115	− 0.182	− 0.220	1.000		

Table 3 (continued)

	Length	LengthSQ	LnLength	Dconstr	Dinformation	Dwholes	Dfood	Dretail	Dmed	Dedu	Dservice	Dother
Dservice	− 0.004	− 0.001	− 0.010	− 0.049	− 0.034	− 0.024	− 0.038	− 0.061	− 0.073	− 0.083	1.000	
Dother	0.005	− 0.001	0.012	− 0.182	− 0.127	− 0.091	− 0.143	− 0.226	− 0.273	− 0.309	− 0.103	1.000

Table 4 Results of ordinary least squares estimation

	Full model	Selected model
S_Seminar	− 0.0686701 (− 1.82)	− 0.0790797* (− 2.15)
S_Information	− 0.0719616 (− 1.79)	− 0.0847588* (− 2.20)
S_Public	− 0.0275002 (− 0.67)	
S_Tax	0.0191582 (0.45)	
S_Incubate	− 0.067497 (− 0.79)	
S_Senior	− 0.0073884 (− 0.18)	
S_Exchange	− 0.0834156 (− 1.79)	− 0.0886553* (− 2.46)
S_Matching	− 0.0147902 (− 0.24)	
S_Family	0.0356296 (1.08)	
S_Foermer	0.1255655** (3.81)	0.1323782** (4.14)
S_Friend	− 0.0090321 (− 0.27)	
Lworkers	0.15061** (7.61)	0.1524072** (7.87)
Age	− 0.0201839 (− 1.71)	− 0.0103004** (− 6.45)
AgeSQ	0.0001106 (0.85)	
Dfem	− 0.0301364 (− 0.69)	
Duniv	− 0.0428732 (− 1.30)	
Dexperi	0.1420674 (3.21)	0.1590831** (3.65)
Dmanager	0.0454043 (1.30)	
Length	− 0.0116915 (− 0.23)	
LengthSQ	0.0004766 (0.49)	0.0002255* (2.25)
LnLength	0.0510892 (0.19)	
Dconstr	0.0460733 (0.42)	
Dinformation	− 0.1225174 (− 1.00)	
Dwholes	0.0908782 (0.64)	
Dfood	− 0.0708957 (− 0.60)	
Dretail	− 0.2272616 (− 2.12)	− 0.1876557** (− 3.87)
Dmed	− 0.2098989* (− 1.96)	− 0.159509** (− 3.56)
Dedu	− 0.1168234 (− 1.11)	− 0.07418 (− 1.75)
Dservice	− 0.1236677 (− 0.92)	
Dother	− 0.0512842 (− 0.51)	
Constant	0.2516181 (0.67)	0.0298051 (0.33)
Adjusted *R*-squared	0.1056	0.1080

t values are in parentheses and * and ** indicate statistical significance at the 5% and 1% levels in two-sided hypothesis testing, respectively

results imply that start-ups in these industries have a lower achievement rate than do start-ups in manufacturing industries on average.

As for the formal support variables, S_Seminar, S_Information, and S_Exchange are selected and all the estimated coefficients are negative and significant. These results imply that the achievement rate is lower when the entrepreneur uses formal support. Of course, this result does not prove causality, so we

should conclude that entrepreneurs who accept formal support fail to achieve their expected monthly sales. As for the informal support variables, only S_Foermer is selected, and it is positive and statistically significant. This result implies that the support from entrepreneurs' former place of employment or its employees is useful in achieving expected monthly sales.

These results from the ordinary least squares estimation could be considered to show the average relationships between the independent variables and start-up performance. If there are differences in the relationships between the independent variables and the performance of high- or low-performing enterprises, the quantile regression approach will reveal them.

Quantile regression approach

According to Koenker (2005), quantile regression is a semiparametric method to estimate the pth quantile of the dependent variable conditional on the independent variables. For example, following the setting of the regression equation in the previous subsection, the pth quantile regression can be expressed as:

$$y_i = \beta_0^{(P)} + x_i'\beta_1^{(p)} + \varepsilon_i^{(p)},$$

where p is the estimated pth quantile and $0 < p < 1$ indicates the proportion of the population scoring below the pth quantile. The pth quantile regression estimates $\beta_0^{(p)}$ and $\beta_1^{(p)}$ are estimated to minimize:

$$\sum_{i=1}^{n} d_p\left(y_i, \hat{y}_i\right) = p \sum_{y_i \geq \beta_0^{(p)} + \beta_1^{(p)} x_i} |y_i - \beta_0^{(p)} - x_i'\beta_1^{(p)}| + (1-p) \sum_{y_i \leq \beta_0^{(p)} + \beta_1^{(p)} x_i} |y_i - \beta_0^{(p)} - x_i'\beta_1^{(p)}|$$

where d_p is the average weighted distance between y_i and $\hat{y}_i (= \beta_0^{(p)} + x_i'\beta_1^{(p)})$. As a result, for example, if $p = 0.95$, there is a higher penalty for underprediction $(0.95|y_i - \hat{y}_i|)$ and a much lower penalty $(0.05|y_i - \hat{y}_i|)$ for overprediction.

Using the quantile regression method, it is possible to analyze for the target enterprises whether important independent variables differ between new start-ups with low achievement rates of the expected monthly sales and new start-ups with high achievement rates. In addition, we should interpret the estimation results with caution because most of the independent variables are dummy variables. The qth quantile of the dependent variable, conditioned by the other control variables within the group of dummy variables with their values set equal to one, is lower when the sign of the estimated coefficient of the variable is negative. If the coefficient is positive, the qth quantile of the dependent variable is higher. In the present paper, we select five quantiles: 0.1, 0.25, 0.5, 0.75, and 0.9. The results of the quantile regression are shown in Table 5. In the estimation process, we remove the variable with the smallest statistically insignificant t-value and then estimate the regression again. We repeat this process until all coefficients are statistically significant at the 10% level.[6]

[6] We adopt the bootstrap method with 200 replications to estimate the standard errors for each coefficient.

Table 5 Results of quantile regression

Quantile	0.1	0.25	0.5	0.75	0.9
S_Seminar	− 0.1035528 (− 1.99)	− 0.1153891* (− 2.57)	− 0.0711074* (− 2.17)		
S_Information	− 0.1465938* (− 2.28)				
S_Senior					− 0.0815754* (− 2.21)
S_Exchange	− 0.1262593* (− 2.09)	− 0.0828049 (− 1.93)	− 0.0921661** (− 2.66)	− 0.0662337* (− 2.20)	
S_Family		0.0617223 (1.80)			
S_Foermer	0.1908409** (3.02)	0.1285358** (3.47)		0.0813396** (2.83)	0.0649358 (1.76)
S_Friend	0.1311425 (1.95)				
Lworkers	0.2300702** (8.37)	0.1795382** (9.50)	0.1271359** (8.83)	0.0490907** (2.69)	0.0511493** (2.65)
Age	− 0.0127256** (− 2.91)	− 0.007639** (− 3.95)	− 0.0285312** (− 2.71)	− 0.0065629** (− 4.95)	− 0.0093771** (− 5.05)
AgeSQ			0.0002334 (1.95)		
Dexperi	0.2586752* (2.35)	0.1966995** (3.51)	0.152813** (3.35)	0.1127617** (3.22)	
LengthSQ				0.0002755* (2.57)	0.0005533** (4.04)
Dconstr	0.237958** (2.58)	0.2175336** (2.75)			
Dinformation			− 0.1645017* (− 2.27)	− 0.21365* (− 1.97)	
Dwholes	0.4838879** (2.64)	0.2158176** (2.60)		− 0.172192* (− 2.33)	
Dretail		− 0.102036 (− 1.86)	− 0.2623842** (− 6.11)	− 0.255104** (− 4.07)	
Dmed		− 0.1209014* (− 2.50)	− 0.2708887** (− 6.29)	− 0.2675209** (− 5.58)	− 0.2620346** (− 6.60)
Dedu			− 0.1889797** (− 4.40)	− 0.2044469** (− 4.29)	− 0.1095102* (− 2.09)
Dservice			− 0.3439876** (− 3.81)		
Dother			− 0.0876463 (− 1.86)	− 0.1000469* (− 2.33)	
Constant	− 0.8224925** (− 3.48)	− 0.4630945** (− 4.19)	0.6403776** (2.74)	0.4077576** (4.92)	0.7627618** (7.78)
Pseudo *R*-squared	0.1224	0.0866	0.0625	0.0493	0.0497

We use the bootstrap method with 200 replications to estimate the standard error of each coefficient

t values are in parentheses and * and ** mean statistically significant at 5% and 1% levels in two-sided hypothesis testing, respectively

Regarding the control variables, Lworkers and Age are selected in all quantiles. The differences in coefficient size by quantile imply that the achievement rates increase with enterprise size at commencement and by entrepreneur age. LengthSQ is selected for $q=0.75$ and 0.9. This means that enterprises whose achievement rate increases with time since commencement are relatively high performing. Dexperi is selected in lower quantile cases, and its estimated coefficients decrease as the quantile increases and equal zero when $q=0.95$. This result implies that managerial experience has a weak effect on relatively high-performing enterprises. Several previous studies have found positive relationships between experience and performance, but these results suggest that the magnitude of their effects differ according to performance. In addition, several dummy variables for the industrial category are selected for some quantiles.

Regarding the variables for informal support, S_Foermer is selected except for the $q=0.5$ case, and its estimated coefficient decreases as the quantile increases. This result implies that informal support from the entrepreneur's former place of employment or its employees has only a weak effect on relatively high-performing enterprises. S_Family and S_Friend are selected and the estimated coefficients of both are positive and statistically significant for the $q=0.25$ and $q=0.1$ cases. These results imply that informal support from parents, spouse, children, or other relatives, or support from friends, acquaintances, or others affects new start-up enterprises positively, but the effect is weaker among relatively high-performing enterprises.

Regarding formal support, S_Exchange is selected in the lower quantile cases; its estimated coefficients are negative, increase with the quantiles, and are zero when $q=0.95$. S_Seminar and S_Information are also selected for some of the lower quantiles. The signs of all estimated coefficients are negative and significant. These results imply that the entrepreneurs who consider that they need these kinds of formal support do not achieve their expected monthly sales, especially among relatively low-performing enterprises. S_Senior is selected in the case $q=0.95$ and its coefficient sign is negative. This result implies that the entrepreneurs who participate in exchange meetings with senior managers lower their monthly sales in relatively high-performing enterprises. Explaining this result is difficult, and further research on this issue is required in the future. In summary, the changes in the estimated coefficients across quantiles indicate that formal/informal supports have good/bad effects on relatively high-performing enterprises, but these are greater on relatively low-performing enterprises.

Conclusion

This paper examines the effects of formal or informal support on the performance of new start-ups. Various types of formal support seem to have negative relationships with the achievement rate of monthly sales. According to the results of the quantile regression approach, these relationships are stronger among relatively low-performing enterprises. The entrepreneurs who accept formal support do not achieve their expected monthly sales targets. Utilization of incubation facilities is included as an independent variable, and our results differ from several previous studies

reviewed by Al-Mubaraki and Busler (2013) and Scagnelli et al. (2019). However, informal support has positive effects on the achievement rate. Both the ordinary least squares and quantile regression results suggest that informal support has positive effects, but these effects become weak among relatively high-performing enterprises. These results may be considered similar to previous investigations that found positive effects of the network on the performance of new start-ups, such as Durda and Ključnikov (2019) and Albourini et al. (2020), or those on the effects of social capital on the performance of new start-ups, such as Liao and Welsch (2005) and Westlund et al. (2014). Our empirical results are consistent with those previous studies, but their results do not imply that the magnitude of their effects differ according to performance. To conclude, our investigation clarifies the relationships between different types of support and the performance of relatively high- or low-performing enterprises. To our knowledge, this is the first empirical research investigation to identify such relationships. Of course, it is difficult to predict at the outset whether the entrepreneur will achieve a high- or low-performing enterprise, so there seem to be fewer practical implications for policy-makers concerning which start-ups should be supported beforehand.

Finally, we present two remaining problems. The first relates to data limitations. The 2015 Survey on State of New Business Start-ups targets new business owners who received loans from the Japan Finance Corporation, so it does not cover all new business owners in Japan. In other words, we cannot control for differences in financial conditions at firm commencement. Several papers, such as Basu and Parker (2001), Hernández-Trillo et al. (2005), Mazanai and Fatoki (2011), Murakami (2007) and Kutsuna (2005), focus on the effects of financial conditions for start-ups. This limitation may affect the results of the regression analysis. In particular, the enterprises that do not meet the conditions to receive financial support from the Japan Finance Corporation because their start-up plans seem insufficient to continue their business are not sampled. This type of selection bias might reduce the sample sizes for relatively low-performing enterprises. Furthermore, some entrepreneurs who do not require financial support from a financial institute such as the Japan Finance Corporation are also not sampled. This type of sampling bias is also the source of sample selection bias in regression estimation. However, we cannot overcome this type of limitation when we use survey data from the Japan Finance Corporation, so we need to access or collect other survey data. The second problem is that we only focus on whether the entrepreneurs use formal or informal support. One survey question asked for a subjective evaluation of each type of support in regard to its usefulness. However, the regression approach cannot use these types of subjective answers because between the error term in the regression equation and these variables for subjective evaluation might be correlated. For example, entrepreneurs may reply "The support is useful" when the enterprise performance is good; this would introduce simultaneity bias in the regression analysis. We, therefore, need to develop another technique to cope with such subjective evaluations in the future.

Finally, we should mention the effects of the coronavirus disease 2019 (COVID-19) pandemic.[7] Currently, COVID-19 is prevalent around the world and may have a disastrous effect on the environment for new start-up enterprises. The effects of this disease differ in quality (direction) and degree (extent) across industries. We should wait for surveys conducted after the end of the pandemic and conduct a similar investigation.

Acknowledgements This research was financially supported by the Japan Society for the Promotion of Science (Grant-in-Aid for Scientific Research: Challenging Exploratory Research, 15K12461 and T18K185740).

Author contributions The authors did the research jointly.

Funding This research was financially supported by the Japan Society for the Promotion of Science (Grant-in-Aid for Scientific Research: Challenging Exploratory Research, JP15K12461 and JP18K185740).

Availability of data and code We used the data from the Center for Social Research and Data Archive in Tokyo University, so please contact the center for the data.

Declarations

Conflict of interest On behalf of all authors, the corresponding author states that there is no conflict of interest.

References

Albourini F, Ahmad A, Abuhashesh M, Nusairat N (2020) The effect of networking behaviors on the success of entrepreneurial startups. Manag Sci Lett 10(11):2521–2532

Al-Mubaraki HM, Busler M (2013) Business incubation as an economic development strategy: a literature review. Int J Manag 30(1):362–373

Basu A, Parker SC (2001) Family finance and new business startups. Oxf Bull Econ Stat 63(3):333–358

Bates T (1990) Entrepreneur human capital inputs and small business longevity. Rev Econ Stat 72(4):551–559

Bosma N, Sanders M, Stam E (2018) Institutions, entrepreneurship, and economic growth in Europe. Small Bus Econ 51(2):483–499

Brüderl J, Preisendörfer P (1998) Network support and the success of newly founded business. Small Bus Econ 10(3):213–225

Carree MA, Thurik AR (2010) The impact of entrepreneurship on economic growth. In: Acs ZJ, Audretsch DB (eds) Handbook of entrepreneurship research. Springer, New York, pp 557–594

Cressy R (1996) Pre-entrepreneurial income, cash-flow growth and survival of startup businesses: model and tests on UK data. Small Bus Econ 8(1):49–58

Durda L, Ključnikov A (2019) Social networks in entrepreneurial startups development. Econ Sociol 12(3):192–208

Gorman G, Hanlon D, King W (1997) Some research perspectives on entrepreneurship education, enterprise education and education for small business management: a ten-year literature review. Int Small Bus J 15(3):56–77

Granovetter MS (1973) The strength of weak ties. Am J Sociol 78(6):1360–1380

[7] Recently, Kuckertz et al. (2020) investigated the start-ups' responses to COVID-19, but there is no related research on the possibilities for structural changes in the factors to encourage new start-ups or help them survive.

Hartog C, Parker S, van Stel A, Thurik R (2010) The two-way relationship between entrepreneurship and economic performance. Scales Report H200822
Hazudin SF, Kader MARA, Tarmuji NH, Ishak M, Ali R (2015) Discovering small business start up motives, success factors and barriers: a gender analysis. Procedia Econ Finance 31:436–443
Hernández-Trillo F, Pagán JA, Paxton J (2005) Start-up capital, microenterprises and technical efficiency in Mexico. Rev Dev Econ 9(3):434–447
Herrington M (2017) Global entrepreneurship monitor policy briefs 2017. https://gemorg.bg/wp-content/uploads/2018/02/gem-2017-policy-briefs-update-200317-1490618072.pdf. Accessed 1 Dec 2018
Honjo Y (2005) Performance of new start-ups. In: Kutsuna K, Yasuda T (eds) New start-up enterprises in Japan. Hakuto Shobo, Tokyo, pp 75–92 **(in Japanese)**
Honjo Y (2010) Economics of entrepreneurship. Doyu-kan, Tokyo **(in Japanese)**
Imai Y, Kawagoe M (2000) Business start-ups in Japan: Problems and policies. Oxf Rev Econ Policy 16(2):114–123
Koenker R (2005) Quantile regression. Cambridge University Press, Cambridge
Kuckertz A, Brändle L, Gaudig A, Hinderer S, Reyes CAM, Prochotta A, Steinbrink KM, Berger ES (2020) Startups in times of crisis—a rapid response to the COVID-19 pandemic. J Bus Ventur Insights 13:e00169
Kutsuna K (2005) Funding for new openings. In: Kutsuna K, Yasuda T (eds) New start-up enterprises in Japan. Hakuto Shobo, Tokyo, pp 127–152 **(in Japanese)**
Liao J, Welsch H (2005) Roles of social capital in venture creation: key dimensions and research implications. J Small Bus Manag 43(4):345–362
Mazanai M, Fatoki O (2011) The effectiveness of business development services providers (BDS) in improving access to debt finance by start-up SMEs in South Africa. Int J Econ Finance 3(4):208–216
Murakami Y (2007) Roles of financial institutions in new business financing. In: Higuchi Y, Murakami Y, Suzuki M, Research Institute of National Life Finance Corporation (eds) Growth and withdrawal of new start-up enterprises. Keiso Shobo, Tokyo, pp 13–54 **(in Japanese)**
Okamuro H (2005) Performance and business relationships. In: Kutsuna K, Yasuda T (eds) New start-up enterprises in Japan. Hakuto Shobo, Tokyo, pp 101–125 **(in Japanese)**
Okamuro H, Kobayashi N (2006) The impact of regional factors on the start-up ratio in Japan. J Small Bus Manag 44(2):310–313
Reynolds PD (2011) Informal and early formal financial support in the business creation process: exploration with PSED II data set. J Small Bus Manag 49(1):27–54
Scagnelli S, Vasile L, Apostolov M (2019) Survival drivers of post-incubated start-ups: the effect of academic governance. Int J Innov Manag 23(7):1950062
Sels L, Vanhoutte C (2006) An inquiry into the impact of pre-startup business planning on new business ventures' performance. Rivista Piccola Impresa/small Bus 2:11–25
Sergi BS, Popkova EG, Bogoviz AV, Ragulina JV (2019) Entrepreneurship and economic growth: the experience of developed and developing countries. In: Sergi BS, Scanlon CC (eds) Entrepreneurship and development in the 21st century. Emerald publishing limited, Bingley, pp 3–32
Staniewski MW (2016) The contribution of business experience and knowledge to successful entrepreneurship. J Bus Res 69(11):5147–5152
Suzuki M (2007a) Supporting policy and characters of the closing enterprise. In: Higuchi Y, Murakami Y, Suzuki M, Research Institute of National Life Finance Corporation (eds) Growth and withdrawal of new start-up enterprises. Keiso Shobo, Tokyo, pp 13–54 **(in Japanese)**
Suzuki M (2007b) Correspondences with the gap between plans and reality. In: Higuchi Y, Murakami Y, Suzuki M, Research Institute of National Life Finance Corporation (eds) Growth and withdrawal of new start-up enterprises. Keiso Shobo, Tokyo, pp 189–212 **(in Japanese)**
Suzuki M (2012) What kind of business relationships encourage the achievements in the beginning? In: Research Institute of Japan Finance Corporation (ed) Trajectory of new start-up enterprises: changes of achievements, resources and consciousness in panel data. Keiso Shobo, Tokyo, pp 167–185 (**(in Japanese)**)
Westlund H, Larsson JP, Olsson AR (2014) Start-ups and local entrepreneurial social capital in the municipalities of Sweden. Reg Stud 48(6):974–994
Wise S, Valliere D (2014) The impact on management experience on the performance of start-ups within accelerators. J Priv Equity 18(1):9–19

Yamada J (2005) Practitioners' partnerships. In: Kutsuna K, Yasuda T (eds) New start-up enterprises in Japan. Hakuto Shobo, Tokyo, pp 27–53 ((**in Japanese**))

Yasuda J (2005) Utilization of policy-based finance. In: Kutsuna K, Yasuda T (eds) New start-up enterprises in Japan. Hakuto Shobo, Tokyo, pp 27–53 ((**in Japanese**))