RIETI Discussion Paper Series 19-E-037

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May 2019

CEOs' multicultural experience, firm networks and performance: Evidence from firm-to-firm transaction data in Japan♦

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Abstract

This paper postulates a hypothesis that, the more diverse background a firm CEO has, the more extended firm-to-firm networks the firm constructs, which in turns leads to higher firm performance. Using the firm level data of firm CEOs' background and firm-to-firm networks, this paper corroborates the hypothesis by showing that the firms whose CEOs are non-local-born are more likely to have more extended firm-to-firm transaction networks and consequently have better firm performance. Aside from this main finding, it also finds that the CEOs' graduated schools' level in terms of difficulty of entrance exams, which we consider as a proxy for CEOs' innate ability has a strong positive nexus with the firm performance. The finding suggests an importance of human resource mobilization for growth.

Keywords: CEOs, Cultural diversity, Firm networks, Firm performance
JEL classification: M21, L20

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♦ This study is conducted as a part of the Project "Innovation Enhancing Regional Economic Structure and Evolution of Cities" undertaken at Research Institute of Economy, Trade and Industry (RIETI). The author is grateful for helpful comments and suggestions by Discussion Paper seminar participants at RIETI. A part of the work for this study is financially supported by Japan Society for the Promotion of Science (KAKEN) Grant number 18H03637.

1. INTRODUCTION

Anecdotes abound as to people's interactions and ensuing innovations. In the era of the renaissance or the industrial revolutions, tea/coffee salons became cradles of new ideas and inventions, where casual talks over coffee/tea sometimes developed into serious and fruitful discussion about new ideas. The merits of human resource diversity are widely recognised as is revealed by casual observations of new technologies and ideas coming from the mega-cities where various types of people gather and come across. When different people work together, it often generates something new. Silicon Valley keeps gravitating human resources and yielding new products or services. It is widely known in the management literature that CEOs exert a strong influence on his/her firm's decision making especially in small and medium sized enterprises (SMEs). In SMEs, because of a simple organisational hierarchy, CEOs are more frequently involved in the everyday business (Ahn, Minshall, and Mortara, 2017). The importance of human resource diversities is argued in various literatures as discussed below. This paper poses a hypothesis that the more diversified experiences in terms of locational cultures firm CEOs has, the firms have more extensive firm-to-firm business networks and it leads to better firm performance using Japanese firm level data.

Literature

This study is related to several literatures. First, it contributes to the literature of firm management, in particular in terms of CEOs characters on firm performance. Second, it contributes to the literature of the role of cultural diversity in knowledge creation. Third, it is related to the literature of firm networks.

In the literature of firm management, Hambrick and Mason (1984) and Hambrick (2007) synthesize the theoretical arguments on the impact of managers' characters and experiences on firms' strategic choices. Constructing a manager-firm matched panel data set of the US Forbes 800 firms, Bertrand and Schoar (2003) documents that a significant extent of the heterogeneity in managerial decision-making are explained by the presence of manager fixed effects. The subsequent literature has been attempting to unveil what constitutes the manager fixed effects. Bogers, Foss and Lyngsie (2018) shows that employees' knowledge diversity and educational background diversity increases firm-level openness, which in turn is known to raise firm performance. Classen, Gils, Bammens, and Carree (2012) finds that attributes of CEO (level of education) relate to so called "search breadth" (the diversity of cooperation partners used for innovation-related activities) of family SMEs. In terms of CEOs characteristics and firms' international activities, Sato and Todo (2012) finds that SMEs are more likely to be internationalized when the CEO is more risk-tolerant, forward-looking, and internationally experienced.

In the literature of the role of cultural diversity in knowledge creation, the importance of spatial barrier and thus "particularity" in his term in human development is argued by Lörsh (1940). Berliant and Fujita (2012) constructs a model on cultural diversity and knowledge creation. In empirical front, Ottaviano and Peri (2006) finds that cultural diversity has a positive effect on the productivity of locals using U.S. data.

As to the literature of firm networks, although the textbook treatment of the theory of firms has been arguing firms' decision through production (cost) functions in terms of labour costs, capital costs and its products market structures, but has paid little attention on networks, recently attention is paid to firm networks as an important ingredient of production function as Kramarz (2014) argues that various networks firms construct also shapes firms' decision and outcomes (profits, growth).

2. DATA

We use two sets of firm level data. The one which includes basic firm information such as address, phone numbers, sales values, number of employee, ordinary profits, and importantly CEOs' information such as birth prefecture, graduated school, is from Teikoku Data Bank, a major credit rating company in Japan. The dataset available to us from RIETI (Research Institute of Economy, Trade and Industry) is limited to the listed companies with more than or equal to 40 employees. We use the most-up-to-date data available at RIETI as of the writing of this paper, namely 2017. The dataset includes the information on 143,036 firms.

The other data we use for firm-to-firm transaction information comes from the Tokyo Shoko Research Data Bank (TSR data), compiled by Tokyo Shoko Research, another credit rating agency. It records both listed and non-listed companies in Japan. The main information in the dataset includes transaction data of both sales and purchase between firms and several facts about each firm, including the year of establishment, the paid-up capital, the total sales value and the number of employees.[1]

3. ANALYSES

This section provides, first, a descriptive statistics of CEOs birthplaces and their firms' locations, second, a study if there is any nexus between CEOs multi-cultural experiences and their firms' performance, and finally econometric analyses to investigate the mechanism mentioned above.

[1] The data of Teikoku Data Bank also contains the information on firm-to-firm transaction link, but only up to 5 partner firms whereas Tokyo Shoko Research Data includes up to 24 partner firms. This is the reason why we combine the two data sets.

3.1. *CEOs' birth places and firms' locations*

For the purpose of investigating on the above-mentioned hypothesis, the best is to confine the dataset to owner-CEO firms because discernible impacts of CEOs' characters on firms' business networks and performance obviously best appear in owner-CEO-firms. Or in other words, in large corporations, the characters of CEOs, whose typical tenure at the job does not last more than five years, do not influence much the firms' business networks. Moreover, if we include large companies, a selection bias is very likely to exist. Namely, clever and/or hard-working people tend to be hired by large companies, which are usually located in big cities, i.e., outside of their birth places. However, the dataset does not contain information for such sorting. Thus, as a second-best solution, we limit the dataset to be used in the main analyses to two sub-samples. One is a sub-sample consisted of firms with single establishment, which is likely to be owner-CEO-(small) firms. The other is a sub-sample consisted of firms which were established after their CEOs turned adults (20 years old) to mitigate selection bias. By doing this, we can mostly rule out the cases where clever and able persons self-select into already established high-performance firms. As a result, the first sub-sample of single establishment firms contains 101,724 firms, out of the total number of 143,035 firms. Table 1 breaks down the 101,724 firms into their location (prefecture) and shows the number of firms run by local-born CEOs. Local-born CEO is defined as CEO who was born in a different prefecture from the prefecture of the firm's location. Out of 101,724 firms, 53,042 firms are run by non-local-born CEOs, which represents 52%. The percentage varies from the lowest of 27 % in Tokyo to the highest of 80% in Tokushima. In terms of the number of firms across prefectures, even with this single-establishment firms, a sizable number of firms, 21,418 out of 101,724 are located in Tokyo.

3.2. *Non-local-born CEOs, non-local-school-graduate CEOs, and firm performance*

Before moving to more precise estimations which follows the mechanism of our hypothesis, i.e., CEOs' multicultural experiences leads to his/her firms' extensive networks, which brings about innovations and ensuing better firm performance, this section takes a "short-cut" to investigate if there is any nexus between the cause (multicultural experiences) and the result (better firm performance), skipping the mechanism (extensive networks). To this end, we estimate the following equation by the ordinary least squares.

$$Sales\_worker = \beta_0 + \beta_1 * Non-local-born + \beta_2 * Non-local-school + \beta_3 * Hensachi + \beta_4 * Number\_worker + u_i + u_j + \varepsilon_{ij} \quad (1)$$

We regress the natural logarithm (hereinafter, log) of sales per worker on the dummy variables of Non-local-born CEO, the dummy variable of non-local-school-graduate CEO, with some control variables, notably the log of "hensachi", a proxy for innate ability of CEOs, which essentially measures the difficulty to get into the school, thus, a kind of school ranking, and the log of number

of employees by the ordinary least square estimation. u_i and u_j are industry fixed effects and prefecture fixed effects, respectively. The estimation results are shown in **Table 2**. The columns of the odd numbers include all the firms in all the prefecture, whereas in the even number columns firms located in Tokyo are excluded from the sample as there is an exceptionally large number of firms run by non-local-born CEOs in Tokyo. The coefficient estimates for Non-local-born CEO are robustly positive with statistical significance at 0.1 percent confidence level. Log of hensachi (school ranking), a proxy for innate ability of CEOs, exhibits highly statistically significant positive coefficient with relatively large magnitude. Non-local-school graduate CEOs shows statistically insignificant coefficient estimates. The estimation result using the whole data set, i.e., not limiting to presumably owner-CEO-firms is in Appendix (Table A.1), which shows qualitatively the same result with those in Table 2. In Table 3, we estimate the same equation with profit per worker as dependent variable. The results are qualitatively very similar to the ones in **Table 2** except that the coefficient estimates of non-local-school are negative with statistical significance in some cases. The coefficient estimates for Non-local-born CEOs are larger than the case with sales per worker as dependent variable. The estimation result only for manufacturing sector is in the appendix (Table A.2). The coefficient estimates for non-local-born CEOs are larger than the case of the all industries, which indicates the importance of extensive networks in the manufacturing sector.

3.3. *Stay (Pure-local), U-turn, I-turn, J-turn*

In this section, we classify the CEOs cultural experience into more disaggregated types than the last section of non-local-born CEOs and non-local-school graduate. The categorisation is four. The first one is what we call “stay” type CEOs, who was born and educated in the prefecture of his or her firm’s location. This type has the least diversified cultural experience. The second one is what we call “U-turn” type CEOs, who was born in the prefecture of his or her firm’s location but graduated from a school located in a different prefecture. The third one is called “I-turn” type CEOs, who was born and educated in a different prefecture and come to the prefecture of his or her firm’s location. The fourth one is terms “J-turn” type CEOs, whose birth place and education place and location of firm are all different. Namely, “J-turn” CEOs has the most diversified locational experiences. An example of “J-turn” is a CEO of a firm located in Okinawa, born in Tokyo but graduated from a University in Hokkaido. Non-local-born and Non-local-school variables in the equation (1) are now replaced by dummy variables of U-turn, I-turn, and J-turn with the reference category being “stay” type. The estimation results are in エラー! 参照元が見つかりません。. Vis-à-vis the reference category of “stay” type, the coefficient estimate of U-turn is not statistically significant, but I-turn and J-turn show statistically significant positive coefficients. Notably, the coefficient of J-turn is larger than I-turn. Namely, the more diversified locational experiences the CEO has, the better the firm performance.

3.4. *Additional estimations for robustness*

3.4.1. Re-definition of local-born-CEOs

In the analyses above, local-born is defined as being born in a different prefecture from the prefecture of firm location. However, there are 47 prefectures in Japan and people commute between adjacent prefectures, such as Chiba-Tokyo, or Saitama-Tokyo. Then, there should not be meaningful impact of non-local born. Although the exclusion of Tokyo in the estimations attenuates this concern at least to some extent, it is far from being perfect. Thus, we group prefectures into regions following a regular classification and redefine non-local born as being born in a region different from the region of the firm location. The estimation results for single establishment firms are shown in Table 5, which are very similar to the cases of Table 2.

3.4.2. The other sub-sample

As mentioned in 3.1., another possible way to proxy the owner-CEO firms is to limit the dataset to those firms which were established after more than 20 years than CEOs birth year. By this, we eliminate those firms which were supposedly established by some other persons, not the current CEOs, and mostly rule out the cases of able persons self-selecting into already established high performance firms. Non-local-born CEOs are defined by regions, not by prefectures, as in the last section. The results showed in Table 6 are similar to those in Table 2.

3.4.3. Panel data

To further address the possibility of reserve causality or self-selection, we construct balanced panel data for the four years, 2002, 2007, 2012, and 2017. By including firm fixed effects, we can essentially capture the effect of the changes of CEOs status (local or non-local) on the firm performance (sales per worker). Estimation results are in Table 7. The coefficient estimates for Non-local-born CEOs are statistically significant with positive sign, except the case of the column (4), whereas Non-local-graduate CEOs is statistically insignificant.

3.4.4. Propensity Score Matching

To address the concern of the endogeneity, this section employs the propensity score matching as another robustness analysis, although admittedly there are few variables which can be used as CEOs' attributes as mentioned below. We use the maximum sample which have non-missing values for the dependent and independent variables. The first table of Table 8 shows the frequency and percentage of non-local born CEOs. Non-local-born CEOs represents 30.79 percent. For Probit estimation to compute the propensity score, the indicator variable of non-local-born CEO, the CEO's birth year and CEO's gender are used as attributes to match the control and the treatment groups. The second table of Table 8 shows the result of Probit estimation. Hensachi shows a highly statistically significant coefficient with positive sign as expected, while CEO's birth year shows a negative coefficient, although very close to zero, at 10 percent significance level. The coefficient estimate for CEO's

gender is statistically insignificant. The estimation result with the nearest neighbour matching is in the third table of Table 8. The average treatment effect of the treated (ATT) is estimated to be positive and statistically significant. The one with the stratification matching is in the fourth table of Table 8, with ATT being positive and statistically significant.

3.5. *Analyses following the mechanism of our hypothesis*

In the above 3.2. and 3.3. we skip the intermediate mechanism of our hypothesis, i.e., firm-to-firm networks. This section makes analyses following the mechanism.

Merging with transaction data

To do analyses which follow the mechanism, we need to merge firm-to-firm transaction information from the TSR data into the above firm and its CEOs information. In order to fully exploit the firm-to-firm transaction link information, we make cross-reference of transaction information, namely merging self- and other- reported linkage. For example, Toyota has a very large number of transaction linkages, but it is asked to report only up to 24 partner firms. If other firms report that they buy from Toyota, we add these firms as Toyota's transaction partner firms, even though they are not reported by Toyota.

Estimations

The first linkage from CEOs multicultural experiences to more extensive firm-to-firm networks is analyzed by estimating the following equation.

$$FirmNetworks = \beta_0 + \beta_1 * Non-local-born + \beta_2 * Number\_wor\ker + u_i + u_j + \varepsilon_{ij}$$

For the degree of extensiveness of firm transaction networks, we use five measures. The first is the sum of distance to all the partner firms. The distance between the two firms is computed using CSV address matching service provided by Center for Spatial Information Science, the University of Tokyo. The second is the mean of distance to all the partner firms. The third is the sum of distance divided by the square-root of the number of partner firms. The third measure intends to give more weight to the number of partners than the simple mean. For example, the mean for 3 partners with the same 50km distance is equal to the mean for 2 partners with the same 50km distance, namely, (50km+50km+50km)/3=(50km+50km)/2. It should be appropriate to treat the former case as a more extensive firm network than the latter case. Thus, we use the square-root for the denominator, i.e., in this example, (50km + 50km)/$\sqrt{2}$<(50km+50km+50km)/$\sqrt{3}$. The fourth measure is the sum of distance weighted by partners' sales per worker and the fifth measures is the sum of distance weighted by partners' profit per worker. Namely, the more and the better (in terms of productivity) partners a firm deals with, the better firm networks the firm constructs. The estimation results are in Table 9.

Non-local-born CEOs shows highly statistically significant coefficient estimates with positive signs for all the transaction measures except for the log of number of partners.

Having seen that there seems to be a positive nexus between CEOs multicultural experience and their firms' transaction networks, we now investigate on the second step, namely, if there is any nexus between the firms' transaction networks and their firm performance. Table 10 shows the estimation results. Here, the firms' predicted transaction networks by the above estimation are the key explanatory variables. All the coefficient estimates for the measure of firm networks show statistically significant positive coefficients.

4. CONCLUDING REMARKS AND DISCUSSION

This paper postulates a hypothesis that, the more diverse background a firm CEO has, the more extended firm-to-firm networks the firm constructs, which in turn leads to higher firm performance. Using the firm level data of firm CEOs' background and firm-to-firm networks, this paper corroborates the hypothesis by showing that the firms whose CEOs are non-local-born are more likely to have more extended firm-to-firm transaction networks and consequently have better firm performance. Aside from this main finding, it also finds that the CEOs' graduated schools' level in terms of difficulty of entrance exams, which we consider as a proxy for CEOs' innate ability has a strong positive nexus with the firm performance. The finding suggests an importance of human resource mobilization for growth.

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Tables and Figures

Table 1: Number of single plant firms by prefecture, local-born CEOs or non-local-born CEOs

Prefecture code	Prefecture name	Number of firms run by local-born-CEOs	Number of firms	Ratio of local-born-CEO-firms
1	Hokkaido	2743	3830	72%
2	Aomori	775	1092	71%
3	Iwate	709	1054	67%
4	Miyagi	983	1761	56%
5	Akita	620	857	72%
6	Yamagata	696	961	72%
7	Fukushima	1010	1549	65%
8	Ibaragi	1002	1811	55%
9	Tochigi	760	1343	57%
10	Gunma	1092	1658	66%
11	Saitama	1148	3495	33%
12	Chiba	963	2805	34%
13	**Tokyo**	**5757**	**21418**	**27%**
14	Kanagawa	1539	4680	33%
15	Niigata	1518	2033	75%
16	Toyama	814	1069	76%
17	Ishikawa	712	1001	71%
18	Fukui	568	760	75%
19	Yamanashi	436	640	68%
20	Nagano	1105	1563	71%
21	Gifu	1038	1523	68%
22	Shizuoka	1963	3028	65%
23	Aichi	3488	5667	62%
24	Mie	789	1318	60%
25	Shiga	382	810	47%
26	Kyoto	963	1676	57%
27	Osaka	3171	7520	42%
28	Hyogo	1607	3056	53%
29	Nara	352	664	53%
30	Wakayama	490	721	68%
31	Tottori	267	450	59%
32	Shimane	394	563	70%
33	Okayama	959	1441	67%
34	Hiroshima	1495	2315	65%
35	Yamaguchi	725	1060	68%

Table 1 continued

36 Tokushima	429	539	80%
37 Kagawa	579	817	71%
38 Ehime	864	1142	76%
39 Kochi	400	582	69%
40 Fukuoka	2233	3788	59%
41 Saga	464	657	71%
42 Nagasaki	750	1043	72%
43 Kumamoto	948	1418	67%
44 Oita	752	1087	69%
45 Miyagi	649	929	70%
46 Kagoshima	1053	1388	76%
47 Okinawa	888	1142	78%
Total	53042	101724	52%

Source: Authors' computation from the firm-level data of Teikoku Data Bank (Year 2017)

Table 2: Estimation results – Non-local-born CEOs, Non-local-school-graduate CEOs, and Sales per worker

Dependent variable: Log of sales per worker	Cross-sectional data of 2017, Limited to single establishment firms							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo
Non-local-born CEOs	0.104***	0.0979***	0.0898***	0.0888***	0.0870***	0.0834***	0.0960***	0.0935***
	(19.50)	(17.69)	(10.82)	(10.33)	(10.42)	(9.63)	(11.58)	(10.91)
Non-local-school graduate CEOs			0.0123	0.0112	0.00377	0.00112	0.00658	0.00438
			(1.50)	(1.32)	(0.46)	(0.13)	(0.80)	(0.52)
Log of hensachi (school ranking)					0.302***	0.214***	0.355***	0.266***
					(11.61)	(7.88)	(13.72)	(9.88)
Log of number of employees							-0.0996***	-0.116***
							(-25.38)	(-26.22)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.515	0.534	0.552	0.588	0.555	0.590	0.563	0.600
Number of observations	100182	79314	40131	31063	39209	30498	39209	30498

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table 3: Estimation results – Non-local-born CEOs, Non-local-school-graduate CEOs, and Profit per worker

Dependent variable: Log of profit per worker

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo
Non-local-born CEOs	0.250***	0.233***	0.205***	0.204***	0.200***	0.191***	0.212***	0.207***
	(16.84)	(14.25)	(8.52)	(7.59)	(8.24)	(7.03)	(8.76)	(7.62)
Non-local-school-graduate CEOs			-0.0293	-0.0423	-0.0464*	-0.0593*	-0.0419	-0.0524*
			(-1.25)	(-1.61)	(-1.96)	(-2.22)	(-1.77)	(-1.97)
Log of hensachi (school ranking)					0.658***	0.433***	0.720***	0.496***
					(8.83)	(5.17)	(9.66)	(5.93)
Log of number of employees							-0.124***	-0.157***
							(-10.79)	(-11.03)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.259	0.215	0.276	0.236	0.278	0.239	0.282	0.244
Number of observations	54864	42719	23377	17987	22856	17647	22856	17647

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table 4: Estimation results - Stay-type, U-turn, I-turn, J-turn, Sales per worker

Dependent variable: Log of sales per worker			Reference category: Stay-type (Local-born, local-school-graduate)			
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo
U-turn type CEOs	0.0379***	0.0426***	-0.0144	-0.0133	-0.0152	-0.0151
	(5.34)	(6.29)	(-1.38)	(-1.27)	(-1.48)	(-1.45)
I-turn type CEOs	0.0741***	0.0930***	0.0521***	0.0513**	0.0541***	0.0504**
	(5.42)	(6.35)	(3.54)	(3.22)	(3.70)	(3.20)
J-turn type CEOs	0.106***	0.129***	0.0893***	0.0828***	0.101***	0.0956***
	(13.23)	(13.54)	(8.63)	(6.88)	(9.81)	(8.03)
Log of hensachi (school ranking)			0.305***	0.220***	0.359***	0.275***
			(11.70)	(8.07)	(13.84)	(10.16)
Log of number of worker					-0.0999***	-0.117***
					(-25.45)	(-26.32)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.514	0.534	0.555	0.590	0.563	0.600
Number of observations	100182	79314	39209	30498	39209	30498

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table 5: Estimation results – Non-local-born CEOs, Non-local-school-graduate CEOs, and Sales per worker, Prefectures grouped into regions

Dependent variable: Log of sales per worker	Cross-sectional data of 2017, Limited to single establishment firms					
	(1)	(2)	(3)	(4)	(5)	(6)
	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo
Non-local-born CEOs	0.0695***	0.0794***	0.0695***	0.0734***	0.0745***	0.0786***
	(7.01)	(7.27)	(7.02)	(6.71)	(7.60)	(7.28)
Non-local-school graduate CEOs	0.00282	0.00568	-0.00821	-0.00591	-0.00800	-0.00497
	(0.34)	(0.67)	(-0.99)	(-0.69)	(-0.97)	(-0.59)
Log of hensachi (school ranking)			0.305***	0.231***	0.357***	0.283***
			(11.40)	(8.21)	(13.44)	(10.18)
Log of number of employees					-0.108***	-0.127***
					(-26.20)	(-27.26)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.549	0.581	0.551	0.583	0.560	0.594
Number of observations	35986	28517	35918	28460	35918	28460

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table 6: Estimation results – Non-local-born CEOs, Non-local-school-graduate CEOs, and Sales per worker (Robustness, Section 3.4.2.)

Dependent variable: Log of sales per worker

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo
Non-local-born CEOs	0.0739***	0.0787***	0.0823***	0.0785***	0.0699***	0.0683***	0.0793***	0.0793***
	(9.80)	(9.56)	(10.84)	(9.54)	(6.49)	(5.99)	(7.41)	(7.02)
Non-local-school graduate CEOs			-0.0804***	-0.0732***	-0.0102	-0.00954	-0.0115	-0.0117
			(-8.86)	(-7.15)	(-0.97)	(-0.85)	(-1.10)	(-1.05)
Log of hensachi (school ranking)					0.347***	0.236***	0.402***	0.288***
					(9.99)	(6.27)	(11.61)	(7.73)
Log of number of employees							-0.0885***	-0.109***
							(-18.50)	(-19.44)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.511	0.532	0.512	0.533	0.553	0.591	0.560	0.600
Number of observations	50869	40398	50869	40398	24543	18299	24543	18299

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table 7: Estimation results – Panel (2002, 2007, 2012, 2017), Single establishment firms or Firms established after 20 years from CEO's birth year

Dependent variable: Log of sales per worker	Panel data of 2002, 2007, 2012, 2017			
	(1)	(2)	(3)	(4)
	Single establishment firms, All prefectures	Single establishment firms, except Tokyo	Firms established more than 20 years after CEOs' birth year, All prefectures	Firms established more than 20 years after CEOs' birth year, Except Tokyo
Non-local-born CEOs	0.0171*	0.0168+	0.0210*	0.0147
	(1.99)	(1.68)	(2.18)	(1.30)
Non-local-school graduate CEOs	-0.00353	-0.00311	-0.00685	-0.00880
	(-0.49)	(-0.40)	(-0.82)	(-0.95)
Log of hensachi (school ranking)	-0.0438	-0.0443	0.00430	-0.0487
	(-1.63)	(-1.51)	(0.12)	(-1.23)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
R-squared	0.913	0.911	0.931	0.929
Number of observations	71496	57890	48456	37093

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table 8: Propensity score matching

Non-local born CEOs	Frequency	Percentage
0	39,539	69.21
1	17,588	30.79
Total	57,127	100

Dependent variable: Non-local-born CEO (Indicator variable:0 or 1)

	Coefficient estimate	Standard errors	z-value	P>z
hensachi	0.0135036	0.0006247	21.62	0
CEO's birth year	-0.0000325	0.0000169	-1.92	0.055
CEO's gender	0.0075097	0.0172296	0.44	0.663

Nearest Neighbor Matching

Number of treated	Number of controls	ATT	Standard errors	t-value
17588	37795	0.108	0.011	9.712

Stratification Matching

Number of treated	Number of controls	ATT	Standard errors	t-value
17588	39526	0.107	0.011	9.655

Table 9: Non-local born CEOs and transaction networks

	(1)	(2)	(3)	(4)	(5)	(6)
	Log of number of partners	Log of number of partners excluding Tokyo	Log of sum of distance	Log of sum of distance excluding Tokyo	Log of mean of distance	Log of mean of distance excluding Tokyo
Non-local-born CEOs	-0.0621***	-0.0722***	0.0675*	0.0789*	0.126***	0.153***
	(-4.47)	(-4.39)	(2.37)	(2.39)	(5.71)	(5.93)
Log of number of employees	0.379***	0.363***	0.474***	0.406***	0.0943***	0.0432***
	(62.62)	(50.48)	(38.10)	(28.01)	(9.76)	(3.80)
Firm age	0.000149***	0.000169***	0.000122	0.000143	-0.0000407	-0.0000357
	(4.08)	(4.45)	(1.63)	(1.87)	(-0.70)	(-0.59)
R-squared	0.571	0.601	0.415	0.418	0.299	0.288
Number of observations	23756	18912	23550	18784	23550	18784

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

	(7)	(8)	(9)	(10)	(11)	(12)
	Log of square-root sum of distance	Log of square-root sum of distance excluding Tokyo	Log of sum of distance times sales per worker	Log of sum of distance times sales per worker excluding Tokyo	Log of sum of distance times profit per worker	Log of sum of distance times profit per worker excluding Tokyo
Non-local-born CEOs	0.0969***	0.116***	0.0592	0.0726	0.107**	0.138**
	(3.95)	(4.07)	(1.68)	(1.70)	(2.73)	(2.91)
Log of number of employees	0.284***	0.225***	0.440***	0.394***	0.424***	0.389***
	(26.48)	(17.93)	(28.60)	(20.94)	(24.55)	(18.48)
Firm age	0.0000407	0.0000538	0.0000202	0.0000965	0.000104	0.000145
	(0.63)	(0.81)	(0.22)	(0.97)	(1.02)	(1.32)
R-squared	0.351	0.342	0.380	0.361	0.327	0.325
Number of observations	23550	18784	23514	18766	21597	17312

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table 10: Firm networks – Sales per worker

	(1)	(2)	(3)	(4)	(5)	(6)
	Sum of distance	Sum of distance	Mean of distance	Mean of distance	Square-root sum of distance	Square-root sum of distance
	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo
VARIABLES	ln_sales_worker	ln_sales_worker	ln_sales_worker	ln_sales_worker	ln_sales_worker	ln_sales_worker
Log of sum of distance	0.0729***	0.0648***				
	(0.00265)	(0.00292)				
Log of mean of distance			0.0273***	0.0168***		
			(0.00347)	(0.00377)		
Log of square-root sum of distance					0.0600***	0.0503***
					(0.00310)	(0.00340)
Log of sum of distance times sales per worker						
Log of sum of distance times profit per worker						
Log of hensachi (school ranking)	0.321***	0.251***	0.327***	0.250***	0.326***	0.253***
	(0.0308)	(0.0321)	(0.0312)	(0.0325)	(0.0310)	(0.0323)
Log of number of employees	-0.131***	-0.134***	-0.0993***	-0.109***	-0.114***	-0.119***
	(0.00513)	(0.00579)	(0.00506)	(0.00574)	(0.00509)	(0.00576)
Observations	23,469	18,722	23,469	18,722	23,469	18,722
R-squared	0.579	0.605	0.566	0.594	0.572	0.598

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

	(7)	(8)	(9)	(10)
	Sum of distance times sales per worker	Sum of distance times sales per worker	Sum of distance times profit per worker	Sum of distance times profit per worker
	All	Except Tokyo	All	Except Tokyo
VARIABLES	ln_sales_worker	ln_sales_worker	ln_sales_worker	ln_sales_worker
Log of sum of distance				
Log of mean of distance				
Log of square-root sum of distance				
Log of sum of distance times sales per worker	0.0532***	0.0468***		
	(0.00216)	(0.00226)		
Log of sum of distance times profit per worker			0.0454***	0.0403***
			(0.00210)	(0.00221)
Log of hensachi (school ranking)	0.321***	0.250***	0.316***	0.241***
	(0.0308)	(0.0321)	(0.0322)	(0.0336)
Log of number of employees	-0.120***	-0.126***	-0.119***	-0.124***
	(0.00507)	(0.00574)	(0.00530)	(0.00601)
Observations	23,434	18,705	21,523	17,257
R-squared	0.578	0.603	0.582	0.606

Standard errors in parentheses
*** p<0.001, ** p<0.01, * p<0.05, + p<0.1

Appendix

Table A.1: Estimation results – Non-local-born CEOs, Non-local-school-graduate CEOs, and Sales per worker with the whole data set

Dependent variable: Log of sales per worker	Cross-sectional data of 2017, Whole data							
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo
Non-local-born CEOs	0.104***	0.0921***	0.100***	0.0930***	0.0965***	0.0856***	0.0981***	0.0879***
	(23.97)	(20.13)	(15.71)	(13.79)	(15.01)	(12.58)	(15.22)	(12.89)
Non-local-school graduate CEOs			0.0198**	0.0160*	0.0106	0.00313	0.0111	0.00380
			(3.14)	(2.39)	(1.67)	(0.46)	(1.75)	(0.56)
Log of hensachi (school ranking)					0.339***	0.271***	0.348***	0.284***
					(17.24)	(13.05)	(17.57)	(13.59)
Log of number of employees							-0.0110***	-0.0193***
							(-3.98)	(-6.03)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.563	0.585	0.600	0.634	0.604	0.637	0.604	0.637
Number of observations	141461	110781	62840	48298	61422	47387	61422	47387

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001

Table A.2: Estimation results – Non-local-born CEOs, Non-local-school-graduate CEOs, and Sales per worker, Manufacturing sector only

Dependent variable: Log of sales per worker, Manufacturing sector only

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo	All	Except Tokyo
Non-local-born CEOs	0.190***	0.190***	0.161***	0.160***	0.151***	0.149***	0.142***	0.143***
	(17.91)	(16.89)	(10.67)	(9.87)	(9.87)	(9.06)	(9.29)	(8.67)
Non-local-school graduate CEOs			0.0387**	0.0426**	0.0279	0.0303	0.0260	0.0289
			(2.61)	(2.70)	(1.86)	(1.89)	(1.74)	(1.81)
Log of hensachi (school ranking)					0.255***	0.209***	0.218***	0.183***
					(5.58)	(4.35)	(4.76)	(3.80)
Log of number of worker							0.0593***	0.0453***
							(7.16)	(4.88)
Industry fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Prefecture fixed effects	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
R-squared	0.281	0.271	0.313	0.310	0.315	0.311	0.319	0.314
Number of observations	21392	18865	9920	8615	9707	8439	9707	8439

t statistics in parentheses

* p<0.05 ** p<0.01 *** p<0.001