Globalization and Internal Corporate Organization: Evidence from Japanese Firms

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Abstract

Recent years have witnessed that firm hierarchies are becoming flatter amid globalization. Span of control (Span) has broadened and the number of levels (Layer) within firms has declined. Motivated by these changes in the world, international trade theory has recently incorporated a rich organizational model into trade and heterogeneous firm contexts. However, empirical evidence for this theory has been so far limited because of the constrained data availability. This paper fills a part of this gap by exploiting a unique firm-level organization data in Japan, by which we can ascertain the relationship between a firm’s organization and its characteristics. Globalization, which is measured by the firm’s foreign sales ratio, has a positive link with Span, but has a negative link with Layer. This finding implies that organizational change is one source of learning effects of globalization.

Key words: globalization, internal organization, firm-level data, learning effects

1 Introduction

Cross-border business activities such as exporting and foreign direct investment (FDI) have been facilitated by trade liberalization and the development of information technology in recent year. A number of business papers and academic literature document that firms have adjusted to the environment by changing their organization. For instance, a multinational corporation General Electric (GE) announced that it reorganized its energy business into three separate business units 1). As the three new business units started to report directly to the CEO, GE’s organization has become “flatter” 2). Motivated by such changes in the world, international trade theory has incorporated a rich organizational model into trade and heterogeneous firm contexts. The theory is so unique that it sheds light on corporate organization which previous heterogeneous firm literature has never taken into account. In order to understand the firm’s globalization, the role of corporate organization in expanding overseas

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1) General Electric distributed press release titled “GE simplifies Energy business,” on July, 20, 2012.
2) As another example of this trend, Japanese major electrical company Panasonic changed its corporation to a flatter organization, as is illustrated in The Nikkei Business Daily (Nikkei-Sangyo-Shinbun in Japanese) dated November 15, 2005.
business can no longer be ignored. Furthermore, several recent studies (e.g. De Loecker 2007, Hijzen, et al. 2011) indicate that firms experience productivity increases after entering into foreign markets. If the current study reveals that globalization of firms has an effect on organization, our finding could be interpreted as suggestive evidence for one source of learning effects, which has been a hot topic in international trade research. The goal of this paper is to empirically examine the relationship between firms’ organizational characteristics and their foreign sales ratio.

The trend of flattening firms is broken down into two components. First, CEO’s span of control has increased. The CEO has been urged to quickly cope with wider, more multidimensional and complex problems than before. Rajan and Wulf (2006) find that CEO’s span of control increased steadily from 1986 to 1998 in a sample of 300 U.S. large firms. Although the number of positions reporting directly to the CEO was 4.4 on average in 1986, it keeps on increasing to 8.2 in 1998. Second, the number of layers within firms has decreased. They found that the number of positions between the CEO and the lowest-level managers with profit center responsibility decreased by more than 25% over the same period 3).

A recent theoretical model enables us to study the internal organization of firms in the globalizing world. Caliendo and Rossi-Hansberg (2012) formalize how a firm decides its internal organization, which is defined by span of control of each agent and the number of layers of management. In their model, firms face heterogeneous demands, which lead to heterogeneity in productivity, output and employment. Because the output that minimizes average cost increases with the number of layers, the optimal number of layers varies depending on the output. As a result of trade liberalization, many of the firms that sell all their output in domestic market reduce their number of layers. In contrast, many exporters increase their number of layers of management. Other studies that link international trade to internal organization of firms include Marin and Verdier (2008, 2010). They show that increasing international trade leads to decentralized corporate hierarchies even though they do not refer to span of control of each agent or the number of layers of management 4).

Empirical studies on the link between international trade and the internal organization remain limited. Guadalupe and Wulf (2010) using the same data as Rajan and Wulf (2006) find that increasing competition due to trade liberalization leads organizations to become flatter. Since they use tariffs as the index of the exposure to market competition for a firm, they do not distinguish between exporters and non-exporters. Similarly, Bloom, et al. (2010a) analyze the effect of market competition on the organizations using 4,000 medium sized manufacturing firms across a dozen countries. They find that the degree of import penetration is associated with greater firm-level decentralization 5). Caliendo, et al. (2012) examine the relationship between the number of layers and firms’ characteristics. They divide French manufacturing firms into a collection of hierarchical layers and find that if expanding firms, including exporters, add their number of layers, these firms decrease their wages.

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3) Other academic literature documenting similar trends in internal organization of firms includes Whittington et al. (1999) and Roberts (2006).
4) Other papers, such as Antràs (2003), Antràs and Helpman (2004) and Conconi, et al. (2012), analyze the firm ownership structure (integration or non-integration) in international economy.
5) In addition, Bloom, et al. (2012) examine the effect of trusts on organizations across nations. They find that trust and rule of law are associated with more decentralization.
Another line of research closely related with this paper is the learning effects of exporting and FDI. Firms gain new knowledge and expertise which allows them to improve productivities after entering into foreign markets. Recent studies by De Loecker (2007) and Hijzen, et al. (2011) have pointed out that firms have significant productivity gains after their entry into foreign markets. The finding of this paper would imply that organizational change is one source of such learning effects because the relationship between organization and firms’ productivities has been already established 6).

Despite growing literature on internal organization within heterogeneous firm, there are no studies linking internal organization with firms’ global activities because of the constrained data availability. This paper exploits detailed firm-level organization data and empirically examines how internal organizations are related to firms’ global activities. Since there are various reasons that firms may change their organizational structures, this study also considers simultaneously other drivers of organizational changes, among which information technology is a prominent candidate 7).

The rest of this paper is organized as follows. Section 2 describes the data. Section 3 summarizes descriptive statistics. Section 4 explains empirical specifications. Section 5 reports estimation results. Section 6 closes with final remarks.

2 Description of Data

2.1 Data source

The organization data used for this paper is derived from The Handbook of Organizational and Systematical Figures (Soshikizu-Keitouzu-Binran in Japanese). This book includes detailed information on divisions, business offices, plants, sections and titles, and their reporting relationships. The data is unique because it allows us to identify hierarchies within firms. These are collected annually from a survey conducted by DIAMOND, Inc. 8) The survey covers listed companies, which are typically major players in their sectors 9). Since our sample is limited to large listed firms, sample selection bias might affect our estimates. In spite of this possible bias, it should be worth exploring our internal organization data due to its uniqueness 10).

This paper focuses on two sectors, electric machinery and chemical industries. There are two reasons for choosing these industries. First, the electric machinery and chemical industries are two of the most globalized industries in Japan 11). Second, these industries inherently have different production processes. It is useful for this study to compare different

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6) Acemoglu, et al. (2007) and Bloom, et al. (2010b) document that organization has an impact on firm performances, for example.
7) Bresnahan, et al. (2002) find complementarities between IT and workplace organization, for example.
8) DIAMOND, Inc. is a large publishing company specializing in businesses and economic issues. It was established in 1933 and has a total staff of 201 employees as of March 2013.
9) As the survey is voluntary, it is possible that firms may not report the exact organization structure because of confidentiality or space limitations in the Handbook. Despite this limitation, this survey is very valuable information for studies of internal organization.
10) Table A1 in Appendix compares the average number of employees, sales and capital-labor ratio with those sampled by Basic Survey of Japanese Business Structure and Activities (Kigyo Katsudo Kihon Chosa in Japanese). Not surprisingly, the sizes and the capital intensity in our sample are larger than those in the survey.
type of industries.

This paper assembles over a 3-year period data from 2008 to 2010. Since some firms are represented as affiliated groups, 37% of observations are dropped and we lose another 22% while cleaning the data. The resulting sample is 253 firms for each year. The previous data set to come close to this sample size is that by Rajan and Wulf (2006) and Guadalupe and Wulf (2010) on about 300 large U.S. firms.

2.2 Measures of internal organizations

Before reporting empirical results, this section discusses two measures of internal organization. First, CEO’s span of control is a measure that captures a horizontal dimension of the hierarchy. It is defined as the number of divisions, business offices, plants and sections reporting directly to the CEO. Since the CEO is at the top of the lines of authority and communication, CEO’s span of control reflects the concept of decision-making at the highest level. The second measure, the number of layers, represents a vertical dimension of hierarchy and is defined as the number of divisions, business offices, plants and sections between the CEO and the lowest section. These two measures have been used repeatedly by previous research such as Rajan and Wulf (2006), Guadalupe and Wulf (2010) and Caliendo and Rossi-Hansberg (2012), although this paper substitutes the lowest section in the organization chart for the division manager\(^\text{12}\).

Figure 1 displays an example of a hierarchy that demonstrates both measures of CEO’s span of control and the number of layers. In this example, the measure of CEO’s span of control is 4, since there are three divisions and one section directly connected to the CEO. On the other hand, the measure of the number of layers is 2, since there are one division and one section between the CEO and the lowest sections (in this case, the plant and the offices are the lowest).

3 Descriptive statistics

3.1 Inter-industry comparisons

This section summarizes descriptive statistics derived from firm-level data. Firms are grouped by their industry. In a subsequent section, this paper will focus on characteristics of firms grouped by their involvement in export and FDI. Tables 1 and 2 present the basic statistics for CEO’s span of control and the number of layers for each year respectively. Two important points emerge from these tables.

First, in the electrical machinery industry, firm hierarchies have been becoming flatter, which puts them in line with the existing evidence. CEO’s span of control increases, which is 12.93 on average in 2008 and it keeps on increasing until it reaches 13.39 in 2010. On the other hand, the number of layers decreases, which is 2.30 in 2008 and it keeps on decreasing until it goes down to 2.26 in 2010. However, the same can not be seen in the chemical

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11) Tomiura (2007) reports that electric machinery industry has the highest share of exporters, FDI firms and firms outsourcing to foreign suppliers among 22 industries in Japan. In addition, it also reports that the chemical industry has the highest percentage of exporters.

12) Rajan and Wulf (2006) and Guadalupe and Wulf (2010) call CEO’s span of control just “Span” and the number of layers “Depth”.

industry, where both CEO’s span of control and the number of layers go up and down. One possible reason is that the observation period is too short to capture any long-term trend. Second, there is the possibility that the internal organizations vary across industries. For example, the chemical industry exceeds the electrical machinery industry in the number of layers. We will control for various factors in regression format to consider differences in technology or in other dimensions 13).

3.2 Inter- and Intra-industry comparisons

This section classifies firms by their engagement in export and FDI. Firms with non-zero export or non-zero sales by FDI affiliates are defined as “globalized firms”, while the other firms, which never export or invest abroad, are defined as “domestic firms”. Tables 3 and 4 compare globalized firms to domestic firms. Two notable differences between these two types of firms emerge from these tables.

13) The distributions of CEO’s span of control and the number of layers are provided in Appendix.
First, internal organizations are considerably different depending on their globalized modes. Globalized firms exceed domestic firms in CEO’s span of control, while domestic firms exceed globalized firms in the number of layers in both industries. Second, internal organizations have different trends depending on their globalized modes in the electric machinery industry, whose hierarchies become flatter on average as shown in Tables 1 and 2. CEO’s span of control in the electric machinery industry steadily increases over the three years among globalized firms, while that of domestic firms fluctuates. On the other hand, the number of layers of globalized firms slightly increases, while that of domestic firms significantly decreases. On the whole, as we see in the previous section, the internal organization in the electric machinery industry becomes flatter. However, the same trend can not be seen in the chemical industry. The evidence above is informative about the differences among firms in the same industry or with similar overseas operations, but it has been confounded by other dimensions of heterogeneity across firms. In the next section, we move to firm-level regressions controlling for various factors.

4 Regression specification

To evaluate the effect of firm’s global activities on their organizations, this paper starts by estimating the following regressions

\[
\text{Span}_{ijt} = \beta \text{Foreignsales}_{ijt-1} + X'_{ijt-1} \gamma + \alpha + \epsilon_{ijt} \\
(1)
\]

\[
\text{Depth}_{ijt} = \rho \text{Foreignsales}_{ijt-1} + X'_{ijt-1} \mu + \delta + \eta_{ijt} \\
(2)
\]
where $i$ refers to a particular firm, $j$ denotes the industry and the time period (year) is indexed by $t$. The dependent variables are the CEO’s span of control in (1) and the number of layers in (2), respectively. The explanatory variable $\text{Foreignsales}$ measures the extent to which a firm is involved in global activities. This measure is defined as the sum of export sales and sales by offshore affiliates over the total sales$^{14}$. If a firm neither exports nor invests abroad, this ratio must be zero. $X$ is a vector of other controls including the IT investment, the number of employees, R&D intensity, capital-labor ratio and other firm characteristics. $\epsilon$ and $\eta$ are the error terms. The results from these regressions are comparable with Guadalupe and Wulf (2010) based on basically the same specifications though they focus on the effect of import penetration on the organizations.

Equations (1) and (2) could suffer from an endogeneity problem. First, some organizational characteristics may lead firms to global activities, which results in a reverse causality problem. For example, Bloom, et al. (2012) show that more decentralized firms tend to be more globally active. Second, it is possible that some omitted variables, such as management quality, have an effect on both variables. In this case, the assumption that $\text{Foreignsales}$ and the error terms are independent is not held. To respond to these problems, all right-hand side variables are lagged by one year. Moreover, this paper also uses an instrumental variable, which is defined as the share of sales for North America (the United States, Canada and Mexico) in total foreign sales. The choice of this instrument is supported by the following argument: the share of foreign sales for a particular region is arguably correlated with the total foreign sales ratios while the destination composition of foreign sales is not supposed to be correlated with corporate internal organization structures$^{15}$.

As this paper exploits the panel nature of the data set, regressions including the firms’ fixed effects to control for unobserved heterogeneity are as follow.

\begin{align*}
\text{Span}_{ijt} &= \beta \text{Foreignsales}_{ijt-1} + X'_{ijt-1}\gamma + \alpha_i + \epsilon_{ijt} \quad (3) \\
\text{Depth}_{ijt} &= \rho \text{Foreignsales}_{ijt-1} + X'_{ijt-1}\mu + \delta_i + \eta_{ijt} \quad (4)
\end{align*}

where $\alpha_i$ and $\delta_i$ are the time-invariant characteristics for firm $i$. Firm-level data for all independent variables are taken from the securities report (Yukashoken-Hokokusho in Japanese). All listed companies are annually required to submit this publicly disclosed report to the government.

The right-hand side variables are expected to have following signs. First, $\text{Foreignsales}$ is positively related with $\text{Layer}$. Caliendo and Rossi-Hansberg (2012) theoretically show that exporters increase the number of layers of management as a result of a trade liberalization. Second, IT investment is positively associated with $\text{Span}$. A number of papers such as Garicano (2000), Bresnahan, et al. (2002), Bartel, et al. (2007), demonstrate that IT is an important determinant of organizational design. Garicano (2000) predicts that a decrease in

$^{14}$ Hence, $\text{Foreignsales}$ (Kaigai-Uriagedaka-Hiristu in Japanese) is defined as (export sales + sales by offshore affiliates) / total sales, which is taken from Japan Company Handbook (Kaisya-Shikiho in Japanese). Disaggregating $\text{Foreignsales}$ into export sales and offshore sales or the volume of import is impossible due to data limitation in the Handbook.

$^{15}$ In order to check the robustness of results, the author replaces North America with Asia region including China, India, Korea, Thailand, Indonesia and has confirmed the robustness of our results.
the cost of communication or the cost of acquiring knowledge increases the span of control, while they may have an ambiguous effect on the number of the layer. Third, the number of employees should be positively related with the internal organization since larger firms tend to have more complex organization. Fourth, R&D intensity might affect the internal organization. Acemoglu, et al. (2007) analyze the relationship between new technologies and organizational change. They show that firms closer to the technological frontier are more likely to choose decentralization. Therefore, this paper includes R&D-sales ratios as a measure of innovative activity. Finally, it is possible that the stock option dummy, which takes the value of one if a firm adopts the stock option, affects the internal organization. Prendergast (2002) and Wulf (2007) point out that decentralized decision-making can be coupled with higher performance pay.

This paper also includes other control variables. Capital/labor (K/L) is the typical determinant of overseas operations in the standard Heckscher-Ohlin factor proportions trade theory. Moreover, the author adds the holding company dummy, which takes the value of one if a firm is the holding company. The holding company whose aim is to own other companies’ stock should have simple internal organizations. The subsidiary dummy, which takes the value of one if a firm is the subsidiary of another company, is also included, as the subsidiary organization might be different because of parent-subsidiary transactions.

5 Estimation results

This section reports our estimation results and discusses their interpretations. Table 5 displays the results of the CEO’s span of control by pooled OLS, IV estimation and Fixed-Effect model in all firms combined (columns 1, 2 and 3) and in each industry (columns 4–6 for the electric machinery industry and columns 7–9 for the chemical industry). The following findings are worth noting.

First, the main coefficient of interest $\beta$ is positive and statistically significant in columns 1, 4 and 7 in the OLS results. Since the coefficient $\beta$ captures the effect of firms’ global activities on their span of control, this finding implies that increases in the foreign sales ratio are associated with wider span of control. The signs of the results are the same in both industries and the magnitudes of estimated coefficients are also similar (0.058 and 0.050). Columns 2, 5 and 8 present the IV results confirming that the main results remain unchanged even when using the instrument $^{16}$.

Second, the IT investment has different effects depending on the industry. The IT investment has a positive link with the span of control in the chemical industry, which is consistent with Garicano (2000). However, it has a negative link in the electric machinery industry. The same results remain in the IV estimates. One possible reason for this difference between industries is that industry combines IT with its production process differently. Products in the electric machinery industry themselves are related to IT, so measured IT investment might include investment in specific products. On the other hand, the IT investment is likely

16) The estimated coefficient $\beta$ with IV for the electric machinery industry (column 5) is smaller than that of the chemical industry (column 8), although the signs are both positive. The difference between industries will be discussed after reporting the result on Layer.
Table 5: Estimation results (Span of control)

| Industry            | [1] | [2]  | [3]   | [4]  | [5]   | [6]  | [7]  | [8]  | [9]  |
|---------------------|-----|------|-------|------|-------|------|------|------|------|
| Estimation method   | OLS | IV FE| OLS FE| OLS FE| OLS FE| OLS FE| OLS FE| OLS FE| OLS FE|
| Foreign sales/Total sales | 0.075  | 0.127   | -0.047 | 0.058 | 0.082  | -0.017 | 0.050 | 0.175 | -0.144 |
|                     | [4.79]*** | [3.37]*** | [-1.31] | [3.27]*** | [1.88]* | [-0.31] | [1.67]* | [2.00]* | [-1.81]* |
| Employee            | 1.042 | 0.991 | -0.337 | 0.994 | 0.976 | -0.494 | 3.985 | 3.005 | 14.398 |
|                     | [6.50]*** | [6.04]*** | [-0.71] | [6.14]*** | [5.90]*** | [-1.02] | [5.62]*** | [2.88]*** | [1.79]* |
| IT/Total assets     | -1.063 | -0.915 | -0.269 | -1.642 | -1.571 | -0.325 | 8.084 | 7.707 | 0.299 |
|                     | [-1.49] | [-1.20] | [-0.82] | [-2.36]*** | [-2.10]*** | [-0.31] | [6.79]*** | [6.07]*** | [1.28] |
| R&D/Total sales     | -10.304 | -11.596 | 1.245 | -6.968 | -8.062 | 2.645 | -22.439 | -36.903 | -9.397 |
|                     | [-2.20]*** | [-2.11]*** | [0.57] | [-1.52] | [-1.55] | [0.81] | [-1.45] | [-1.75]* | [-0.54] |
| Capital/labor (K/L) | 10.332 | 11.665 | -1.280 | 0.266 | -0.261 | 0.174 | 22.862 | 37.758 | 9.665 |
|                     | [2.14]*** | [2.06]*** | [-0.57] | [0.29] | [-0.03] | [0.38] | [1.43] | [1.74]* | [0.54] |
| Stock option Dummy  | 0.033 | -0.008 | -0.012 | -0.020 | -0.033 | -0.023 | 2.379 | 1.303 | -0.213 |
|                     | [0.71] | [-0.15] | [-0.62] | [-0.48] | [-0.69] | [-0.44] | [1.09] | [0.68] | [-0.74] |
| Holding Dummy       | -5.667 | -6.008 | -4.091 | -3.853 | -8.515 | -9.034 |          |          |        |
|                     | [-3.39]*** | [-3.15]*** | [-2.25]*** | [-2.20]*** | [-3.76]*** | [-3.66]*** |          |          |        |
| Subsidiary Dummy    | 0.370 | 0.977 | 1.402 | 1.700 | -1.963 | -0.561 |          |          |        |
|                     | [0.47] | [1.11] | [1.41] | [1.54] | [-1.55] | [-0.39] |          |          |        |
| Electric Dummy      | -1.713 | -2.262 |          |          |          |          |          |          |        |
|                     | [-2.37]*** | [-2.57]*** |          |          |          |          |          |          |        |
| Constant            | 10.971 | 9.957 | 15.128 | 9.726 | 9.080 | 14.816 | 8.734 | 7.231 | 4.379 |
|                     | [18.87]*** | [13.19]*** | [12.42]*** | [16.73]*** | [7.34]*** | [7.23]*** | [14.16]*** | [7.05]*** | [0.66] |
| Adjusted R-squared  | 0.335 | 0.318 | -0.004 | 0.417 | 0.413 | -0.006 | 0.332 | 0.288 | 0.067 |
| N                   | 506   | 506   | 506   | 306   | 306   | 306   | 200   | 200   | 200   |

Note: The asterisks ***, ** and * denote the statistical significance at 1%, 5% and 10%, respectively. T statistics (in parentheses) are computed from Heteroskedasticity-robust standard errors. All explanatory variables are one-year lagged.
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to be related with corporate activities of the whole company in the chemical industry, as predicted by the theory.

Third, the larger a firm is, the greater span of control it has, confirming the existing evidence such as Guadalupe and Wulf (2010) and Caliendo, et al. (2012).

Fourth, controlling for the firms' fixed effects reduces the statistical significance of many of the independent variables. As the detailed description of the data in tables A4 and A5 indicate, there is little variations in the internal organization within a firm across three years. Therefore, the firm-specific characteristics (the firm dummy) explain a large part of the variations in the internal organization.\(^{17}\)

Fifth, not surprisingly, the holding company dummy has a negative effect on the span of control. The holding company clearly tends to have narrower span of control.

Finally, other control variables are not necessarily statistically significant. Although the signs of R&D coefficient are negative and statistically significant in the whole sample, they are not significant in each industry. The similar results can be seen in K/L.

Table 6 displays the results in the number of layer. The noteworthy findings are as follows. First, the coefficient of Foreignsales is negative and statistically significant. Increases in the foreign sales are associated with the fewer Layer. Although this outcome differs from the implication predicted by Caliendo and Rossi-Hansberg (2012), this finding is in line with the result of Bloom, et al. (2012) which show that multinationals are more likely to decentralize. Thus, the decline of the number of layers could reflect delegation. The absolute sign of negative impact on Layer in the chemical industry is larger than that in the electric machinery industry. On the other hand, as we reported, the positive coefficient in the chemical industry is larger especially with IV in the case of Span. Firms in the chemical industry might be pressured to change for speedy decision making to cope with global activities, possibly because the organization of firms in the chemical industry tends to be more complex due to intensive R&D.

Second, IT investment is significant and negatively related with Layer. This finding might suggest that IT investment is the driver of decreasing the number of layers. Guadalupe and Wulf (2010) find that the communication technology (CT) investment has the positive link with Layer. This difference might come from our data on IT investment where CT investment is not distinguished among IT in general.

Third, Fixed-Effect model reduces the statistical significance of most of the independent variables, as in the case of Span. Fourth, R&D intensity is negatively associated with Layer in the whole sample and in the electric machinery, as consistent with the result by Acemoglu, et al (2007) but not in the chemical industry. One possible reason for this difference is that technology progress in the electric machinery industry is more dynamic than the chemical industry during our sample period. Finally, the holding company dummy and subsidiary dummy have a negative effect on Layer, as expected.

\(^{17}\) The F-test indicates that the null hypothesis that all the firm-specific effects are zero is rejected at the 1% significance level.
| Industry                      | [1]  | [2]   | [3]    | [4]     | [5]     | [6]     | [7]     | [8]    | [9]   |
|------------------------------|------|-------|--------|---------|---------|---------|---------|-------|------|
| Estimation method            | OLS  | IV    | FE     | OLS     | IV      | FE      | OLS     | IV    | FE   |
| Foreign sales/Total sales     | -0.008 | -0.018 | 0.005 | -0.007 | -0.017 | 0.003 | -0.014 | -0.025 | 0.013 |
| [4.83]*** [-3.97]*** [0.61] | [-3.78]*** [-3.01]*** [0.31] | [-2.39]** [-2.34]** [0.60] |
| Employee                      | 0.008 | 0.017 | 0.102 | 0.006 | 0.014 | 0.111 | 0.101 | 0.186 | -1.076 |
| [1.21] [1.96]* [1.12] | [0.93] [1.60] [1.19] | [1.62] [2.01]** [-1.06] |
| IT/Total assets               | -0.673 | -0.700 | -0.035 | -0.517 | -0.547 | -0.043 | -2.435 | -2.402 | 0.082 |
| [-3.75]*** [-3.98]*** [-0.75] | [-5.60]*** [-5.08]*** [-0.80] | [-13.02]*** [-13.01]*** [0.50] |
| R&D/Total sales               | -1.676 | -1.439 | -0.378 | -2.009 | -1.534 | -0.775 | -0.991 | -0.264 | 3.184 |
| [-3.08]*** [-2.46]** [-0.86] | [-3.78]*** [-2.23]** [-1.38] | [-0.46] [0.10] [1.56] |
| Capital/labor (K/L)           | 1.728 | 1.439 | 0.390 | 0.357 | 1.624 | 0.135 | 1.034 | -0.258 | -3.280 |
| [3.08]*** [2.46]** [0.86] | [0.33] [1.07] [0.80] | [0.46] [-0.10] [-1.56] |
| Stock option Dummy            | 0.034 | 0.041 | 0.003 | 0.037 | 0.042 | 0.007 | -0.021 | 0.072 | -0.168 |
| [6.32]*** [6.70]*** [0.86] | [6.76]*** [6.14]*** [1.42] | [-0.13] [0.40] [-0.84] |
| Holding Dummy                 | -1.022 | -0.959 | -0.897 | -1.001 | -0.804 | -0.759 |      |       |      |
| [-3.98]*** [-3.78]*** [-2.48]** | [-2.64]*** [-5.38]*** [-4.99]** |       |
| Subsidiary Dummy              | -0.404 | -0.515 | -0.479 | -0.608 | -0.293 | -0.414 |      |       |      |
| [-2.84]*** [-3.40]** [-2.54]** | [-3.05]*** [-1.38] | [-1.66]* |
| Electric Dummy                | -0.455 | -0.355 |      |      |      |       |       |       |      |
| [-5.09]*** [-3.60]*** |       |       |       |
| Constant                      | 3.116 | 3.302 | 2.240 | 2.665 | 2.946 | 1.991 | 3.162 | 3.292 | 3.561 |
| [40.37]*** [29.40]*** [8.64]*** | [29.33]*** [21.26]*** [5.88]*** | [28.22]*** [29.40]*** [3.65]*** |
| Adjusted R-square             | 0.177 | 0.124 | -0.003 | 0.101 | 0.009 | 0.006 | 0.052 | 0.024 | -0.006 |
| N                            | 506  | 506   | 506    | 306    | 306    | 306    | 200    | 200   | 200   |

Note: The asterisks ***, ** and * denote the statistical significance at 1%, 5% and 10%, respectively. T statistics (in parentheses) are computed from Heteroskedasticity-robust standard errors. All explanatory variables are one-year lagged.
6 Concluding remarks

This paper empirically examines how internal organizations are related to firms’ global activities using firm-level data. In order to study this relationship, this paper uses firm-level data in Japan over the year 2008 to 2010. This paper first divides firms’ organizations by the extent of firm’s global activities and compare their features. The disaggregation shows that exporters or FDI firms exceed domestic firms in CEO’s span of control (Span) on average, while domestic firms exceed exporters or FDI firms in the number of layers (Layer). Then this paper estimates firm-level regressions controlling for various factors. The major findings of regressions are threefold. First, the organizations of more globally engaged firms tend to have broader Span. Second, they also tend to have fewer Layer. Third, IT investment has a negative link with Layer.

The findings of this paper have important policy implications. The learning effects of global activities are supported by De Loecker (2007), Hijzen, et al. (2011) and Girma and Görg (2004). They show that exporter and FDI firms become productive following their globalization decisions. On the other hand, it is also evident that the corporate organization affects the firm’s performance (Acemoglu, et al. 2007, Bresnahan, et al. 2002). These two lines of studies combined imply that organization could be one of the important channels to link firms’ global activities to their productivities. This paper is an attempt to focus on this unexplored link. As there are restrictions to prevent firms from reorganizing in many countries, facilitating organizational change might make the link stronger. For instance, improving regulations on mergers and acquisition might help globalization of firms. In addition to this policy implication, this paper could be regarded as suggestive evidence for the learning effects of globalization as we now detected significant relation of globalization with the firm’s internal organization, which is in turn confirmed to be associated with the firm’s productivity.

Although this paper reports informative firm-level observations, cementing the generality of this finding will be desirable in the future studies. One will also find it interesting to seek firms’ organization data which are linked with trade liberalization in longitudinal format and identify the causal effect among firms’ organization, international trade and their productivities.

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Appendix. Data Description

**Figure A1**: Span of control in 2008

![Graph showing the span of control for Electric machinery and Chemical industries in 2008.](image)

**Figure A2**: Number of layers in 2008

![Graph showing the number of layers for Electric machinery and Chemical industries in 2008.](image)

**Table A1**: Comparisons with the average in Basic Survey of Japanese Business Structure and Activities (BSJ)

|                      | Electric machinery | Chemical |
|----------------------|--------------------|----------|
|                      | Our sample         | BSJ      | Our sample | BSJ      |
| Number of employees  | 2,135              | 622      | 810        | 501      |
| Sales                | 182,406            | 46,870   | 79,827     | 40,114   |
| Capital/labor (K/L)  | 12.7               | 10.7     | 27.6       | 24.8     |

Notes: The original data of sales are in millions of yen.
Source: The securities report, Basic Survey of Japanese Business Structure and Activities
### Table A2: Correlation matrix of electric machinery industry

|                      | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Foreign sales/Total sales | [1] | 1.00 |     |     |     |     |     |     |
| Employee             | [2] | 0.18 | 1.00|     |     |     |     |     |
| IT/Total assets      | [3] | -0.01| -0.003| 1.00|     |     |     |     |
| R&D/Total sales      | [4] | 0.19 | 0.003| -0.01| 1.00|     |     |     |
| Capital/Labor (K/L)  | [5] | 0.16 | 0.01 | -0.01| 0.08| 1.00|     |     |
| Stock option Dummy   | [6] | 0.09 | 0.00 | 0.02 | 0.34| -0.01| 1.00|     |
| Holding Dummy        | [7] | 0.03 | -0.05| -0.02| 0.10| 0.56| -0.01| 1.00|
| Subsidiary Dummy     | [8] | -0.13| -0.04| -0.01| -0.01| -0.05| 0.14| -0.05| 1.00|

Source: The securities report

### Table A3: Correlation matrix of chemical industry

|                      | [1] | [2] | [3] | [4] | [5] | [6] | [7] | [8] |
|----------------------|-----|-----|-----|-----|-----|-----|-----|-----|
| Foreign sales/Total sales | [1] | 1.00 |     |     |     |     |     |     |
| Employee             | [2] | 0.49 | 1.00|     |     |     |     |     |
| IT/Total assets      | [3] | 0.01 | -0.02| 1.00|     |     |     |     |
| R&D/Total sales      | [4] | -0.01| -0.03| 0.15| 1.00|     |     |     |
| Capital/Labor        | [5] | -0.02| -0.03| 0.15| 0.05| 1.00|     |     |
| Stock option Dummy   | [6] | 0.32 | 0.24 | -0.01| -0.04| -0.04| 1.00|     |
| Holding Dummy        | [7] | 0.03 | -0.07| -0.01| -0.01| -0.01| 0.20| 1.00|
| Subsidiary Dummy     | [8] | -0.10| -0.01| -0.01| -0.02| -0.02| 0.05| -0.03| 1.00|

Source: The securities report
### Table A4: Basic statistics of electric machinery industry

| Variable                        | Mean  | S.D. | Min | Max | Observations |
|---------------------------------|-------|------|-----|-----|--------------|
| **Span of control**             |       |      |     |     |              |
| overall                         | 13.21 | 9.25 | 1   | 71  | N=459        |
| between                         | 9.08  | 1    | 69  |     | n=153        |
| within                          | 1.84  | -0.79 | 22.21 | T=3 |
| **Number of Layers**            |       |      |     |     |              |
| overall                         | 2.28  | 0.88 | 1   | 5   | N=459        |
| between                         | 0.82  | 1    | 4.33|     | n=153        |
| within                          | 0.32  | 0.95 | 3.61|     | T=3          |
| **Foreign sales/Total sales**   |       |      |     |     |              |
| overall                         | 32.66 | 27.33| 0   | 100 | N=459        |
| between                         | 27.22 | 17   | 100 |     | n=153        |
| within                          | 3.01  | 1    | 44  |     | T=3          |
| **Employee**                    |       |      |     |     |              |
| overall                         | 2.15  | 5.64 | 0.01| 37.28| N=459        |
| between                         | 5.64  | 0.01 | 0.01| 35.16| n=153        |
| within                          | 0.34  | -1.95| 4.26|     | T=3          |
| **IT/Total sales**              |       |      |     |     |              |
| overall                         | 0.02  | 0.13 | 0   | 2.58| N=459        |
| between                         | 0.07  | 0    | 0.86|     | n=153        |
| within                          | 0.10  | -0.84| 1.74|     | T=3          |
| **R&D/Total sales**             |       |      |     |     |              |
| overall                         | 0.06  | 0.08 | 0   | 0.64| N=459        |
| between                         | 0.06  | 0    | 0.38|     | n=153        |
| within                          | 0.04  | -0.17| 0.43|     | T=3          |
| **Capital/Labor (K/L)**         |       |      |     |     |              |
| overall                         | 0.16  | 0.40 | 0   | 4.92| N=459        |
| between                         | 0.33  | 0    | 3.28|     | n=153        |
| within                          | 0.23  | -2.96| 1.80|     | T=3          |
| **Stock option Dummy**          |       |      |     |     |              |
| overall                         | 0.34  | 0.47 | 0   | 1   | N=459        |
| between                         | 0.45  | 0    | 1   |     | n=153        |
| within                          | 0.16  | -0.33| 1   |     | T=3          |
| **Holding Dummy**               |       |      |     |     |              |
| overall                         | 0.02  | 0.15 | 0   | 1   | N=459        |
| between                         | 0.15  | 0    | 1   |     | n=153        |
| within                          | 0.04  | -0.64| 0.36|     | T=3          |
| **Subsidiary Dummy**            |       |      |     |     |              |
| overall                         | 0.10  | 0.30 | 0   | 1   | N=459        |
| between                         | 0.30  | 0    | 1   |     | n=153        |
| within                          | 0     | 0.10 | 0.10|     | T=3          |

Notes: In “Observations” column, N refers to the total observations; n refer to the number of firms; T refers to the year when data are available.

Source: The securities report and The Handbook of Organizational and Systematical Figures (Soshikizu-Keitouzu-Binran in Japanese).
### Table A5: Basic statistics of chemical industry

| Variable                      | Mean   | S.D.   | Min   | Max   | Observations |
|-------------------------------|--------|--------|-------|-------|--------------|
| Span of control overall      | 13.18  | 8.85   | 2     | 54    | N=300        |
| between                      | 8.72   | 3      | 51.67 | n=100 |              |
| within                       | 1.71   | 4.18   | 19.85 | T=3   |              |
| Number of Layers overall     | 2.91   | 0.98   | 1     | 6     | N=300        |
| between                      | 0.90   | 1      | 5.33  | n=100 |              |
| within                       | 0.39   | 1.25   | 4.25  | T=3   |              |
| Foreign sales/Total sales    | 19.73  | 17.96  | 0     | 68    | N=300        |
| between                      | 17.93  | 0      | 67.33 | n=100 |              |
| within                       | 1.77   | 9.73   | 26.73 | T=3   |              |
| Employee overall             | 0.82   | 1.06   | 0.04  | 6.23  | N=300        |
| between                      | 1.06   | 0.04   | 6.07  | n=100 |              |
| within                       | 0.06   | 0.22   | 1.15  | T=3   |              |
| IT/Total sales overall       | 0.01   | 0.05   | 0     | 0.80  | N=300        |
| between                      | 0.03   | 0      | 0.27  | n=100 |              |
| within                       | 0.04   | -0.26  | 0.54  | T=3   |              |
| R&D/Total sales overall      | 0.16   | 1.48   | 0     | 18.34 | N=300        |
| between                      | 1.21   | 0      | 12.17 | n=100 |              |
| within                       | 0.86   | -11.20 | 6.33  | T=3   |              |
| Capital/Labor (K/L) overall  | 0.14   | 1.38   | 0     | 17.80 | N=300        |
| between                      | 1.12   | 0      | 11.27 | n=100 |              |
| within                       | 0.80   | -11.12 | 6.67  | T=3   |              |
| Stock option Dummy overall   | 0.21   | 0.41   | 0     | 1     | N=300        |
| between                      | 0.39   | 0      | 1     | n=100 |              |
| within                       | 0.12   | -0.46  | 0.87  | T=3   |              |
| Holding Dummy overall        | 0.01   | 0.10   | 0     | 1     | N=300        |
| between                      | 0.10   | 0      | 1     | n=100 |              |
| within                       | 0.00   | 0.01   | 0.01  | T=3   |              |
| Subsidiary Dummy overall     | 0.07   | 0.26   | 0     | 1     | N=300        |
| between                      | 0.26   | 0      | 1     | n=100 |              |
| within                       | 0.00   | 0.07   | 0.07  | T=3   |              |

Notes: See note to Table A4.
Source: The securities report and The Handbook of Organizational and Systematical Figures (Soshikizu-Keitouzu-Binran in Japanese).
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