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Abstract

In this paper we analyze the effect of perceived global competition on firms' reorganization plans, allowing for heterogeneous effects across firms. Using detailed firm-level survey data on Japanese manufacturing small and medium-sized enterprises (SMEs), we demonstrate that these firms have become more labor-intensive. Manufacturing SMEs recognizing fierce global competition are more willing to consider replacing native production workers with low-skilled immigrants although reluctant to increase investment in research and development (R&D). We find this effect to be significantly stronger for firms with a high production worker ratio and less initial wage growth. As a channel between perceived global competition and future immigrant employment plans, the difficulty in retaining young workers plays an important role, while the decline in future R&D investment is directly related to the perception of increased global competition.

Keywords: globalization, immigrants, R&D, SMEs, labor-intensity
JEL classification: D22, F66, J15

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1 Introduction

Increased global competition can influence a firm's organization in several ways. In the United States, for example, competition with Chinese imports led to technical change within firms and a reduction in the share of unskilled workers (Bloom et al. 2016). Studies on offshoring have made similar findings; offshoring to low-wage countries has changed the composition of firms' workforces by increasing the share of high-skilled, technology-related, and non-production workers (Becker et al. 2013; Mion and Zhu 2013; Hummels et al. 2014, 2018; Bernard et al. 2020).

However, many labor-intensive small- and medium-sized enterprises (SMEs) in the manufacturing sector can only deal with global competition in a limited manner due to financial and human capital constraints. These manufacturing SMEs cannot afford to invest in offshore production facilities and therefore continue domestic production. This lack of affordability makes such domestic manufacturing SMEs consider cutting production costs to compete with cheaper foreign products. Manufacturing SMEs that try to achieve cost reduction have an incentive to hire low-skilled immigrant workers at a lower wage than existing production workers because the reservation wage of low-skilled immigrants from developing countries is generally less than that of equivalent workers in developed countries. It is, thus, quite likely that fierce foreign competition makes domestic manufacturing SMEs choose more labor-intensive production using low-skilled immigrant workers from the available domestic workforce.

Even though some manufacturing SMEs switch their domestic production workers to low-skilled immigrant workers, it is not a given that those firms will continue labor-intensive production. They could become a less labor-intensive organization by increasing research and development (R&D) investment into producing high-value-added products. Global competition boosts the attractiveness of investing in the capital- or skill-intensive production technologies or less labor-intensive product mixes (Pierce and Schott 2016). Capital- or R&D-intensive firms are more likely to survive and grow in the wake of import competition (Bernard et al. 2006; Homebert and Matray 2018). In this situation, cheap, low-skilled immigrant labor is considered temporary until labor-saving production can be implemented. Manufacturing

SMEs may increase R&D investment while conserving personnel costs by hiring low-skilled immigrant production workers. If SMEs choose instead to maintain labor-intensive production, investment in labor-saving technology should be suppressed.

This study examines the interplay between firms' perception of global competition and their plans on low-skilled immigrant employment and R&D investment and clarifies the reorganization process by focusing on Japanese manufacturing SMEs. To investigate this interplay, we require data on when firms that have not yet hired low-skilled immigrants start thinking about hiring them and investing in R&D as they face fierce global competition. A survey of Japanese manufacturing SMEs conducted in 1996 that we use for this analysis, which includes detailed information on the perception of intensifying globalization and plans for low-skilled migrant hiring and R&D investment, fulfills all of these conditions.[1] Although this survey data is cross-sectional, there is little concern regarding simultaneity between globalization and firms' reorganization because firms' *past* to *present* issues are used as the explanatory variables, and firms' *future* organizational strategies are used as the explained variables. Our data also contain information on firm productivity, which is rarely observed. The productivity indices enable us to address the omitted variable bias problem. Furthermore, by merging firm-level survey data with industry-specific import penetration ratios (IPRs), we can determine whether SMEs plan organizational changes due to a subjective sense of crisis or as an objective response to the competitive environment. This study's motivation is similar to the case study by Almeida et al. (2012), which investigated how organization-based matters influence the recruitment of immigrant professionals in Australia.

Our analysis indicates that manufacturing SMEs recognizing fierce global competition were more willing to consider replacing native production workers with low-skilled immigrants while being reluctant to invest in more R&D. Regression analysis shows that the probability of firms recognizing fierce global competition to plan to hire low-skilled immigrants increases by 9.9 percentage points, and the probability

[1] In Japan, imports from China increased most in the 1990s, during which time many Japanese firms likely recognized the intensification of globalization. During the 1990s, immigration policy was revised to permit the legal employment of non-highly skilled foreigners, and Japanese firms with stagnant growth began to think about changing their traditional organizations. The details will be discussed in Section 3.

of increasing future R&D investment decreases by 21.1 percentage points. Thus, manufacturing SMEs have become more labor-intensive organizations in recognition of global competition. When allowing for heterogeneous effects, we find that among firms realizing globalization, those with a high ratio of production workers and that do not have a shortage of production workers tend to consider hiring immigrants. Conversely, firms realizing fierce global competition with less initial wage growth for new hires could not afford to think of increasing future R&D.

Moreover, we highlight the existence of a potential channel through which manufacturing SMEs may develop into labor-intensive organizations after recognizing severe global competition. For the manufacturing SMEs in our sample, there was a decline in the retention of native young workers in parallel with firms' perception of intensifying globalization. This problem prompted firms to consider hiring immigrants. Poor employee retention in the manufacturing sector caused by global competition is consistent with Autor et al. (2015), who discovered the significant negative effects of globalization on employment.

Our results imply that manufacturing SMEs recognizing fierce global competition and having difficulty retaining young employees intend to hire cheaper, low-skilled immigrant production workers and reduce their R&D investment, which results in more labor-intensive production. In contrast to previous studies like Pierce and Schott (2016) that did not focus on SMEs, we find that as a result of global competition, manufacturing SMEs do not become organizations that employ mainly high-skilled or technical workers.

This study makes three contributions to the existing literature. First, it clarifies the interplay between the perception of global competition and plans for future immigrant employment and R&D investment. The interplay between immigration, capital, and trade is essential to understand the way globalization affects economies (Freeman 2006). However, trade's impact on capital is often analyzed independently from immigrants' impact on the labor market. Studies such as Bloom et al. (2016) and Yamashita and Yamauchi (2020) have discussed the influence of import competition on R&D investment. Reskin et al. (1999) and Parrotta et al. (2014) demonstrated the significant positive labor diversity for firms in more trade-open industries. Assuming that there is an interplay between immigrant employment and future capital

investment and that these are simultaneous decisions for firms as Freeman (2006) pointed out, they should be analyzed in tandem.

Second, this study examines how SMEs in developed countries respond to global competition. In a globalized economy, some low-skill work that cannot be automated in developed countries heads for the developing world (Autor et al. 2015). However, exports and offshoring are significantly positively correlated with plant size (Bernard and Jensen 2004; Biscourp and Kramarz 2007; Hummels et al. 2018; Bernard et al. 2020). As Melitz and Trefler (2012) established, a firm's international expansion entails some upfront fixed costs; only the best-performing firms can justify these initial investment costs. Therefore, SMEs, which often cannot bear these initial fixed costs, are likely to cope with global competition differently than large firms. However, few studies have explicitly quantitatively analyzed how SMEs change their organization in recognition of global competition. Mion and Zhu (2013) and Hummels et al. (2014) demonstrated that global competition promotes a shift to technology-related workers in manufacturing but did not account for the heterogeneous effect of global competition according to firm size. Our argument is also related Bernard et al. (2020), who revealed a channel through which offshoring affects firm reorganization. However, these studies did not consider the link between global competition and SMEs' future human resource strategy. If the heterogeneity between offshore firms above a certain size and SMEs that do not expand overseas is great, then SMEs may exhibit different effects other than shifting toward less labor-intensive production and upgrading employee skill, as determined by Artuç et al. (2010) and Autor et al. (2015) in their regional and industrial unit analyses. Thus, analyses that consider firm heterogeneity and focus on SMEs are important. One exception is Biscourp and Kramarz (2007), who found that the association between increasing imports of goods and the elimination of unskilled jobs is found only in large firms. However, they did not examine the possibility of SMEs replacing unskilled jobs with immigrant workers, which is the focus of this study.

Third, we identify the determinants of firms' shift to immigrant employment by comparing firms with and without future plans to hire immigrants. Many previous studies have reported the effect of immigrant workers on wages and employment for native workers (Borjas 2003; Alesina and Ferrara 2005; Longhi et

al. 2005; Ottaviano and Peri 2006; Dustmann et al. 2013; Suedekum et al. 2014). These studies measured immigrant employment outcomes but did not address why some firms hire immigrant workers while others do not. The first reason is that in countries with a high immigration ratio, immigrant employment is already quite common, making it difficult to identify the underlying reasons for the phenomenon. The second reason is that firms' decision on whether or not to promote organizational diversity has remained largely unobserved by researchers. Contrary to the approach of using data that includes firms with immigrant workers, the data used in this study is only of firms that plan to but have not yet hired immigrant workers; this study eliminates any confounding by post-employment outcomes. By taking advantage of the unique features of this data, we successfully exclude the consequences (i.e., feedback effects) of immigrant employment, which enables us to identify its determinants.

The remainder of this paper is organized as follows. Section 2 outlines our hypotheses and empirical specifications. Section 3 describes the data and stylized facts. Section 4 examines the effects of perceived global competition on a firm's future strategy. Section 5 investigates the relationship between the retention of young workers and a firm's future reorganizational plans. Section 6 concludes.

2 Globalization and the Transformation of Firms

2.1 Hypotheses

Thesmar and Thoenig (2000) showed that firms' organizational choices are influenced by external conditions such as globalization in both theory and practice. Acemoglu et al. (2015) suggested that an increase in offshoring opportunities causes a decline in unskilled workers' real wage, skill-biased technical changes, and rising skill premiums. Many empirical studies have supported the implications of these theories. Purchasing inputs produced by cheap labor in developing countries replaces tasks previously performed by expensive workers in developed countries, which results in the displacement of existing domestic workers and a reduction in their wages (Feenstra and Hanson 1997; Ebenstein et al. 2014; Hummels et al. 2014). The decline in the employment and wages of blue-collar workers is also driven by a

shift to less labor-intensive production in developed countries (Grossman and Rossi-Hansberg 2008; Pierce and Schott 2016). Due to globalization, the international specialization between developed and developing countries has improved, enabling firms to locate their production and R&D functions in a location that maximizes their productivity and profits.

However, only the most productive firms, which tend to be the largest, can afford the cost of moving abroad (Peters 2017). Since the initial cost of offshoring is too high for some labor-intensive SMEs, few SMEs in developed countries can relocate overseas. To survive in the competitive market, many domestic SMEs are therefore forced to strike a balance between using domestic workers and offering products at a lower cost.

There are two possible strategies that domestic SMEs competing with inexpensive imports may pursue to maintain profitability. The first strategy is that while continuing labor-intensive production, SMEs might switch from the relatively higher-paid workers they currently employ to lower-paid workers. If low-skilled immigrant workers have a lower reservation wage than native workers—as is often the case—then SMEs' employers have an incentive to replace their current native production workers with immigrant workers in the future.[2] Globalization may encourage SMEs in developed countries to change their demand for labor and hire more immigrants as low-skilled production workers.

The second strategy is to shift to labor-saving, technology-related production. By doing so, SMEs may increase their R&D investment to produce less labor-intensive and high value-added differentiable products. It then becomes necessary to make the employees highly skilled (Bresnahan et al. 2002). However, if developing or recruiting a highly skilled workforce takes time, SMEs may consider hiring migrant production workers temporarily until they shift to labor-saving production systems. In other words, firms could save on labor costs by hiring low-skilled migrant workers and increasing their R&D investment.

[2] Studies such as Scheve and Slaughter (2001) and Mayda (2006) have shown that workers with the same skills as immigrants who are exposed to unemployment or wage decline do not welcome an increase in the supply of immigrant labor. Despite such reluctance to work with immigrants, employers nonetheless hire immigrant workers when they expect that doing so will increase profits. Moriarty et al. (2012) explored Irish employers' pursuit of immigrant labor rather than other strategies such as increasing productivity or mobilizing alternative sources of labor.

Therefore, the direction of R&D investment is ambiguous, as SMEs' affected by global competition may increase or decrease their R&D investment as a result.

Based on this discussion, we derive two hypotheses on the possible ways that SMEs may deal with global competition as follows:

- SMEs recognizing fierce global competition seek lower-paid labor and plan to hire less skilled immigrant workers in the future.
- The decision of SMEs recognizing fierce global competition to increase or decrease R&D is ambiguous.

Note that this study focuses on firms' *perception* of intensified global competition to analyze their organizational choices because the relationship between the objective intensification of globalization and firms' organizational choices will always be mediated by how firms feel the effects of global competition. Therefore, in this study, the term "global competition" means perceived competition with foreign competitors that produce similar products unless otherwise noted. Even at firms in the same region and industry, employers' recognition of global competition can differ, thereby making their organizational strategies for the future distinct.

The productive benefits and possible costs associated with low-skilled immigrant employment and R&D investment are also likely to be heterogeneous. Such heterogeneity in net expected benefits means that not every firm will employ immigrant workers and increase R&D investment. Among such diverse firms, the SMEs that plan to hire immigrants or increase R&D investment expect the resulting net productive benefits to be positive.

2.2 Empirical Framework

Since manufacturing employment is strongly affected by intensifying import competition, as discussed, we first examine the relationship between the perception of global competition and the willingness to hire less skilled immigrants. In parallel, we analyze whether the perception of global competition affects firms' future R&D strategies. The employment of low-skilled immigrants indicates that a firm will maintain labor-

intensive production; increasing R&D investment indicates that a firm is pursuing high value-added, labor-saving, and capital-intensive production.

Our baseline empirical model is as follows:

$$Y_{isd}^{f} = \delta(globalization_i^c) + X_i\beta + \mu_s + \varphi_d + \varepsilon_i \quad (1)$$

Y_{isc}^{f} represents a plan relative to firm i in sector s and district d. We analyze two firm-level plans—immigrant employment and R&D investment. μ_s and φ_d indicate a set of fixed effects to capture sector- and district-specific unobserved factors, respectively, affecting firms' plans. X_i captures a set of firm-specific controls—(log) capital stock, firm age, (log) number of employees, and an indicator variable for unions. The explanatory variable of interest is $globalization_i^c$, a binary variable that indicates whether a firm is currently recognizing increased overseas competition. Estimating a positive δ implies a positive effect of the perception of globalization on a firm's plan. Standard errors are clustered at the city level to account for the correlation across firms.

First, if firms are inclined toward labor-intensive production in response to the perception of global competition, they may consider hiring immigrants and spending less on R&D. Thus, the relationship with the perception of global competition, δ, is expected to be positive for immigrant employment and the opposite for R&D investment. However, if immigrant employment is temporary, both future immigrant employment and R&D investment plans are expected to be positively related to global competition. Finally, when the perception of global competition results in a reduction in the number of production workers and a shift toward more skilled employees and labor-saving production, we expect a negative correlation between global competition and immigrant employment and a positive one with R&D investment.

However, if the correlation between omitted productivity-increasing variables and the globalization variable is positive, δ will be positively biased. Usually, such omitted variable bias is dealt with by controlling for unobserved time-invariant factors affecting firm outcomes using panel data. In this study, this approach is unavailable because we use data from a one-time, cross-sectional survey. Instead, we

directly control for the level and growth of firm productivity based on each firm's entry wage and growth rate over the past 5 years.

Furthermore, to address the issue that firms' perception of global competition is a subjective and endogenous variable, we consider the objective impact of globalization by using the past IPR of each sector as an exogenous instrumental variable (IV).[3] Finally, reverse causality is of little concern because firms' *past* to *current* situations are used as the explanatory variables while their *future* organizational strategies are used as the explained variables.

3 Data and Stylized Facts

Our analysis requires detailed firm-level data to investigate the relationships between a firm's perception of global competition and its plans for immigrant employment and R&D investment because utilizing firm-level data can provide direct evidence of globalization's impact on firm outcomes. For example, Bernard and Jensen (1997) and Biscourp and Kramarz (2007) demonstrate that a significant observed decline in manufacturing employment due to import competition occurred within firms. Moreover, the use of firm-level data provides an intra-industry variation that allows researchers to control for industry-level shocks to demand or technology (Hummels et al. 2018).

We use Japanese firm-level data from "The Survey on Manufacturing SME Management in the Global Economy," which was conducted in 1997 by the Research Institute for Advancement of Living Standards (*Rengo Soken*). This survey data have a rich set of firm variables, including the perception of global competition and human resource issues that can shed light on firm reorganization following immigrant employment and R&D investment plans. This Japanese data have three advantages over recent data. First, while most of the world's countries began competing with China after it joined the World Trade Organization in 2001, Japan experienced growth in imports from China in the 1990s, before most other

[3] We assume that increased global competition is an exogenous influence on SMEs.

countries. Second, Japan's institutional reforms in the 1990s paved the way for the legal employment of non-highly skilled immigrants. In response, there has been a remarkable increase in the number of immigrants from Asian and South American countries working for minimum wage in so-called "3D" jobs (i.e., dull, dangerous, and dirty jobs) at Japanese manufacturing SMEs (Inagami 1992).[4] In the 1990s, the employment of low-wage, low-skilled immigrants became an option for Japanese firms. Third, the 1990s was a turning point at which Japan's productivity plunged into a period of stagnation (Baily et al. 2020), forcing corporations to shift from the growth model.

To estimate the relationship between global competition and immigrant employment and R&D investment plans, panel data covering the 1990s and 2000s, such as those used by Bernard et al. (2020), are desirable. Although our data is a cross-sectional survey, it provides information on the perception of globalization's impact as experienced in the *past*, *current* human resource issues, and plans for migrant hiring and R&D investment. In other words, since the time series of each variable used in the analysis is clear, we can analyze whether fierce global competition in the past induced firms to move toward immigrant employment and R&D investment. Our data also allow us to directly control for the level and growth of productivity of the sample firms. The details will be discussed in the next section. This mitigates the bias caused by the correlation between the error term and the explanatory variables, which is a challenge in ordinary cross-sectional data.

This survey does not ask direct questions regarding whether a firm hires or plans to hire immigrant workers; instead, it asks about the types of production workers currently employed and those that the firm intends to employ in the future. The respondents chose from one of the following four responses—(1) regular (native) workers, (2) non-regular (native) workers, (3) immigrant workers, and (4) not applicable.

Until the early 1990s, most Japanese firms consisted only of native regular employees (*seishain*) with stable salaries and a long tenure. In the latter half of the 1990s, firms gradually switched some of their employees from regular to non-regular workers (*hiseishain*) with lower pay and limited tenure. While many

[4] The share of immigrant workers of the overall labor force was approximately 1% in the 1990s, one of the lowest figures among Organization of Economic Cooperation and Development (OECD) countries.

manufacturing firms hired native high school graduates as regular or non-regular production workers, the number of firms hiring immigrant workers gradually increased during the 1990s.[5]

Based on the responses to the previous questions, we split the sample firms into three groups. A firm that had already employed immigrant production workers is coded as an "already hiring (AH) firm." A firm that had not employed immigrant production workers at the time of the survey but was willing to do so in the future is coded as a "future hiring (FH) firm." A firm that had neither hired immigrant production workers at the time of the survey nor planned to hire them going forward is coded as a "not hiring (NH) firm."[6]

The differences between AH and NH firms include not only the determinants of immigrant worker employment but also the consequences of hiring them, which is called the "feedback effect."[7] No feedback effect can be observed in FH and NH firms because they had not yet employed immigrant workers. Therefore, comparing FH and NH firms identifies the reason why firms consider hiring immigrant workers. We estimate Equation (1) based on the sample of FH and NH firms.

However, not including AH firms in the analysis might cause serious sample selection bias by excluding larger SMEs because previous studies such as Mitaritonna et al. (2017) and Marchal and Nedoncelle (2019) found that firms employing immigrants are relatively larger. In fact, in our sample, AH firms have 28.3 more employees on average than FH and NH firms. However, the interest of this study is not to observe the average effect of SMEs overall but, rather, to examine the extensive margin of the subset of SMEs that do not currently employ immigrants and are willing to do so. Therefore, instead of including AH firms in the analysis, we address the sample selection problem by conditioning firm size, which is considered to be a confounding factor affecting both the perception of global competition and immigration employment and R&D investment plans for the future.

[5] At SMEs, migrant production workers have been employed almost exclusively as non-regular workers or technical intern trainees.
[6] Of the 642 sample firms, 40 are AH firms, 47 are FH firms, and the remaining 555 are NH firms.
[7] Marchal and Nedoncelle (2019) showed that immigrants foster firms' exports. This is an example of the feedback effect generated by immigrant employment.

The summary statistics of the variables used in this paper are reported in Table 1. This includes both FH firms and NH firms. In appendix table A1, we provide the summary statistics for each of the three firm types, including AH firms, separately. There is almost no significant difference in the variables among the firm types, indicating that each type of firm does not feature distinctive observable characteristics. In addition, Appendix table A2 shows basic statistics and cross-group comparisons according to whether or not a firm will increase its future R&D investment.

4 Empirical Results

4.1 Effect of Globalization on Future Immigrant Employment and R&D Investment Plans

The estimations using the logit model in Equation (1) are presented in Table 2. To address the bias caused by the confounding factor of firm size, we condition the capital stock and the number of employees. We also add firm age and a union dummy, which may also be associated with organizational choice, as explanatory variables. To facilitate the interpretation of the coefficients, we show the marginal effects of the explanatory variables.

The results in Column (1) provide a positive and statistically significant relationship between perceived globalization and future immigrant employment plans. The estimated coefficient of 0.068 indicates that the probability of firms recognizing fierce global competition being more willing to hire immigrants increases by 6.8 percentage points, all else being equal. This is because the coefficient is the average marginal partial effect calculated for a hypothetical firm in which the values of regressors other than the global competition dummy are equal to the sample mean.

Column (5) displays the relationship between perceived global competition and future R&D investment plans in our base sample, which are also shown in Table 2. The coefficient of -0.159 indicates that the probability that a firm realizing fierce global competition plans to invest more in R&D in the future than it does today is reduced by approximately 15.9 percentage points.

In this analysis, we treat firms' perception of global competition as exogenous for the willingness to hire immigrants and invest in R&D. However, the validity of the results would be threatened if other factors correlated with global competition affect immigrant employment or R&D investment.[8] Because firms have developed different preferences based on their productivity (Melitz 2003; Mitaritonna et al. 2017), each firm's productivity may affect its willingness to hire immigrants and invest in R&D. To address this omitted variable problem, we additionally control for the heterogeneity of firm productivity. Fortunately, we can use information on production workers' initial monthly salary, both current and as of five years ago, as proxy indicators for firm productivity, which is rarely observed. Controlling the initial salary from five years ago and its increase over the last five years satisfies the conditional mean independence assumption. Assuming that the productivity variables are correlated with the error term, after conditioning on these variables, the mean of the error term does not depend on the firm's immigrant employment plan or the R&D investment plan variable.

Columns (2)–(4) list the relationship between perceived global competition and immigrant employment plans after controlling for the log of the initial monthly salary of production workers and its growth rate over the last five years. Columns (6)–(8) list the corresponding relationships between perceived globalization and R&D investment plans. In Columns (2) and (6), we repeat the base analysis about immigrant employment plans, adding the initial monthly salary from five years ago, and in Columns (3) and (7), we include salary growth to control for firm productivity. Columns (4) and (8) present the initial monthly salary from five years ago and salary growth, respectively. In Columns (2)–(4), we still discover a positive and statistically significant relationship between perceived global competition and immigrant employment plans. In addition, these effects are larger than those of the base models. When firm productivity is not considered, there seems to be an omitted variable bias in the specification which diminishes the relationship between perceived global competition and immigrant employment plans. In Columns (6)–(8), the corresponding effects of perceived global competition on future R&D plans are

[8] Simultaneity is not likely to present an issue in this study. Although we used cross-sectional data, we used three variables at different points in time: past globalization, current issues, and future strategies.

negative and significant, in line with the base model, although these values are greater than those of the base model. We confirm that none of these overturns our results; the estimates change remarkably little when we include controls for a firm's productivity and growth.

As discussed above, the global competition used in this analysis is based on each firm's subjective perception of intensified global competition. If unobserved factors affect this perception, it could make the global competition measure used in this analysis endogenous. To deal with this issue, we attempt to estimate IPR by industry as an IV of each firm's perception of global competition, assuming that it is caused by the growing IPR of its industry. The IPR is assumed to have the exogenous variation in the import share as a predictor for global competition because variations in the import share are mainly driven by large companies such as multinational corporations that export, on which individual SME has little impact. Following Hombert and Matray (2018), the variable IPR for the broad industry classes is defined as the amount of import in the industry in 1996 divided by the industry employment in 1994. In the appendix table A3, we document the IPR of the 15 industrial sectors used in this analysis.[9].

IV estimation results show that both immigrant employment and R&D investment plans are not significantly related to firms' perception of global competition. (The results are not reported here to save space). After conducting the Durbin–Wu–Hausmann endogeneity test, however, we do not reject the null hypothesis that the perceived global competition variable is exogenous. Therefore, the perceived global competition variable should be treated as exogenous, and there is no need for the instrument in this analysis.

However, IPR, an objective measure of international competition, may directly affect firms' plans to hire immigrants and invest in R&D. Panel A in Table 3 exhibits the estimation results using IPR as an explanatory variable instead of subjective perceived global competition. They show no effect of IPR on firms' immigrant employment and increased R&D investment plans.

[9] Data on imports and employment in the industry come from the RIETI JIP database, available at https://www.rieti.go.jp/jp/database/JIP2018/index.html. We used industry-level imports from 1996 rather than contemporaneous ones because current imports are likely endogenous.

Finally, we also examined whether firms' exporting status was associated with their future immigrant employment and increased R&D investment plans (Panel B in Table 3). When we do not control for firm productivity, there is a weak positive correlation between the immigrant employment plan and export dummy. However, this relationship disappears when controlling for firm productivity. No significant relationship was observed between R&D investment plans and firms' exporting status. We did not observe a clear relationship between export status and a firm's future reorganization plan.

These results demonstrate that manufacturing SMEs recognizing fierce global competition are more likely to plan to hire immigrant workers and, at the same time, invest less in R&D. This suggests that the perception of global competition is likely to induce SMEs to become more labor-intensive rather than labor-saving and productivity-enhancing. This is consistent with the hypotheses posited in Section 2. Our findings are complementary with the results of Lewis (2011) for the United States, in which low-skilled immigration was associated with the adoption of unskilled-intensive technology. Furthermore, in this sample, IPR, which objectively indicates the competitive environment, exhibited no explanatory power, indicating that firms' organizational choice depends more on their perception of the severity of global competition than on whether industry import competition is actually severe.

4.2 Firm Heterogeneity in Organizational Choices

We are also interested in whether immigrant employment and R&D investment plans in response to perceived global competition depend on initial labor intensity, a shortage of production workers, or wage growth. Considering firm heterogeneity, we can augment the average effect on immigrant employment and R&D investment plans across the sample firms. For example, if firms lacking sufficient native production workers seek immigrants to compensate for this deficiency, they may remain labor-intensive. However, if firms with a sufficient number of native workers replace them with comparable immigrants to conserve costs for R&D investment, they may benefit more from productive cost-cutting and substitution, becoming more skill-intensive. Furthermore, by considering firm heterogeneity, we can capture the relationship between firm growth and plans to increase low-skilled immigrant employment and R&D investment.

Similar to Mitaritonna et al. (2017), we modify our baseline model to reflect firm heterogeneity as follows:

$$Y_{isd}^{f} = \delta_1(globalization_i^c) + \delta_2(globalization_i^c) * I_i\left(k_i \geq \underline{k}\right) + X_i\beta + \mu_s + \varphi_d + \varepsilon_i \qquad (2)$$

The difference from Equation (1) is the addition of the interaction term between the variable of perceived global competition and the index term. The explanatory variables of interest are (i) $globalization_i^c$, whether firm *i* currently realizes increased competition from overseas; and (ii) the interaction of this variable with the dummy $I_i\left(k_i \geq \underline{k}\right)$, which selects firms whose characteristic k_i was over a certain threshold $\underline{k}$, usually chosen to be the median of that characteristic over the sample. This variable aims at capturing the heterogeneous effect depending on firm characteristics.

We estimate three different specifications depending on the choice in firm characteristic *k*. First, we consider the production worker ratio of firm *i*, and, in this case, the threshold is the sample median of its ratio; then, the shortage of production workers dummy variable, and, in this case, the threshold is zero; finally, we consider the ratio of the initial wage change from five years ago to the present wage at firm *i* and, in this case, the threshold is also the sample median.

We analyze two outcomes, Y_i^f at the firm level—immigrant employment plans and increased R&D investment plans—similar to the analysis in the previous section. Estimating a positive δ_1 implies a positive effect of perceived global competition on these outcomes for firms with k_i below the threshold. Conversely, a positive δ_2 coefficient implies that perceived global competition has a stronger effect on that outcome in firms above the threshold. We estimate Equation (2) for FH and NH firms. The standard errors are clustered at the city level to account for the correlation across firms and over time within a geographic area.

Table 4 shows the estimated parameters on the explanatory variables of interest for Equation (2) using FH and NH firms in our dataset and two outcomes as the dependent variables. On the left-hand side of Panel A in Table 4, we can observe that firms with a current production worker ratio above the median have

a substantial increase in the probability of considering immigrant employment if a firm recognizes fierce global competition. The left-hand side of Panel B in Table 4 indicates that the probability of considering hiring immigrants is significantly higher for firms that are aware of increasing global competition but do not have a shortage of production workers. Null coefficients are estimated for the interaction effects in Columns (5)–(8) of Panels A and B in Table 4. This suggests that firms' responses to plans to increase R&D investment are homogeneous, even when they differ in terms of the production worker ratio and their perception of the shortage of production workers.

When allowing for heterogeneous effects, we find that among the firms that recognize globalization, those with a high production worker ratio and that do not have a production worker shortage tend to consider hiring immigrants. These results imply that firms that perceive fierce global competition are willing to replace native production workers with immigrants with a lower reservation wage and continue their labor-intensive production. Conversely, the negative correlation between the perception of globalization and plans to increase R&D investment was caused by firms at which the initial wage growth was relatively low. In other words, firms that could not increase the wage of entry-level workers sufficiently in reacting to the impact of global competition tended to decide against increasing their future R&D investment.

5 Channel between Globalization and SME's Future Strategies

5.1 Globalization and Retaining Young Workers

The analysis in the previous section confirmed that among firms that recognize the intensification of global competition, those that were already labor-intensive with a sufficient number of productive workers had a higher probability of considering hiring immigrants, and those that could not increase workers' wages refrained from increasing R&D investment in the future. In this section, we discuss the role of labor supply constraints on domestic workers as a mediating factor between the perception of globalization and the planned hiring of immigrants and investment in R&D.

As a result of trade openness, the inflow of goods produced by cheap labor overseas depresses the prices of comparable goods in developed countries. Companies producing these goods for the domestic market will be forced to lower their production costs, leading to lower wages for currently employed workers (Autor et al. 2013). Globalization therefore makes the manufacturing sector less attractive for workers because increased competition decreases the price of manufacturing products, and manufacturing firms can no longer pay the same level of wages as before. This will be followed by labor force shifts from the tradable goods industry, in which wages are restrained, into the non-tradable goods industry, in which wages are still maintained (Acemoglu et al. 2016). At that time, manufacturing SMEs producing tradable goods might suffer from the separation of native workers[10] and plan for firm reorganization.

In light of the above discussion, we examine the retention problem of young native workers between the perception of global competition and future organizational choices. First, we confirm whether perceived global competition influences *current* workers' retention by SMEs, followed by a discussion on the link between the retention of young employees and *future* low-skilled immigrant employment or R&D investment plans.[11]

Panel A in Table 5 shows the linear correlation coefficients between perceived global competition and the retention of young workers across sample SMEs. We use a measure from the survey as an index of workers' retention: dummy for whether a firm suffers from difficulty retaining young native workers. We include the same control variables and fixed effects as in the last section. The coefficients on perceived global competition are approximately 0.14, which indicates a statistically significant positive relationship between perceived fierce global competition and difficulty in retaining young workers. In Panel B in Table 5, we use industry-level IPRs rather than the perception of global competition to demonstrate the relationship with the difficulty retaining young workers. The coefficients on IPR are statistically

[10] Autor et al. (2014) argued that individuals who worked in manufacturing industries that experienced high subsequent import growth spent less time working in their initial manufacturing industries and more time working outside of manufacturing.

[11] The challenge remains that this analysis cannot distinguish the simultaneity between the perception of globalization and the retention of young workers. However, Autor et al. (2013) and Acemoglu et al. (2016) have implied that globalization most likely triggered the employment mobility of young workers.

indistinguishable from zero. This means that firms facing global competition are associated with suffering from poor employee retention. However, the increase in imports faced by the industry did not lead to the difficulty in young workers' retention in the sample firms.

5.2 The Effect of Retaining Young Workers on Firm Reorganization

In the last section, we found that difficulty retaining young workers is positively associated with the perception of fierce global competition, not with objective industry-level IPR. Next, we discuss if the problem of poor retention prompts plans for future immigrant employment and increasing R&D investment. We add a dummy variable for the difficulty of retaining young workers as an explanatory variable to Equation (1) to block the path of the direct effect of perceived global competition on immigrant employment and increased R&D investment plans. After adding this variable, if the coefficient of retaining young workers is significant and the coefficient of perceived global competition becomes non-significant, the relationship between perceived global competition and firm's future reorganization is explained by the difficulty retaining young workers.

The estimation results of Panel A in Table 6 report all of the significantly positive relationships between immigrant employment planning and difficulty retaining young workers at the 1% level. Column (1) displays our base sample. The corresponding estimates with productivity indices, in Columns (2)–(4), are consistent with but greater than the base estimate reported in Column (1). Conversely, the coefficients of perceived global competition become non-significant.

These results imply that the relationship between perceived global competition and future immigrant employment plans works due to the SMEs' difficulty in retaining young workers. In other words, the effect of perceived globalization is indirectly attributed to firms' willingness to hire immigrant workers. For manufacturing SMEs, immigrant employment planning seems to be associated with firms suffering from the retention of native production workers and being anxious about a possible future labor shortage.

In Panel B in Table 6, the effect of the difficulty retaining young workers on future R&D investment is totally insignificant in contrast to its effect on immigrant employment plans. There seems to be no evidence

that difficulty retaining young workers increases the possibility that firms will increase investment in future R&D. However, the coefficients of the perceived global competition dummy are negative and statistically significant. The magnitude of these coefficients is not so different from the results of the basic model in Table 2; the probability that an SME that perceives global competition would invest more in future R&D decreases by approximately 20 percentage points. These results indicate that the decline in future R&D investment is not due to difficulty retaining young workers but is directly related to the perception of increased global competition.

6 Concluding Remarks

Using detailed Japanese firm-level data, we studied the effect of perceived global competition on manufacturing SMEs reorganization plans. As firms are heterogeneous in terms of productivity and human resource issues, we also analyzed if the response to perceived global competition differed according to initial productivity or the sufficiency of production workers. Three empirical regularities emerged from the analysis. First, manufacturing SMEs recognizing fierce global competition are more likely to start hiring low-skilled immigrant workers. At the same time, they plan to invest less in R&D. Second, when allowing for heterogeneous effects, we find that among firms that recognize globalization, those with a high production worker ratio and that do not have a production worker shortage tend to consider hiring immigrants. Conversely, firms that could not increase the entry-level wage of workers sufficiently tended to think that they could not increase future R&D investment. Third, the effect of the difficulty retaining young workers plays an important role as a channel between perceived global competition and future immigrant employment plans. In contrast, the decline in future R&D investment is directly related to the perception of increased global competition.

As a consequence, the perception of fierce global competition induces firms to become more labor-intensive rather than labor-saving and productivity-enhancing across manufacturing SMEs. The validity of our findings is supported by the fact that the number of firms employing low-skilled immigrants has

gradually increased over the last three decades since the 1990s and that Japanese SMEs' productivity has continued to stagnate along with firms' less R&D investment.[12] We also showed that manufacturing SMEs, unable to keep hiring young workers, sought to hire low-skilled immigrants to cut costs and survive in the competitive global marketplace. If many SMEs stick to labor-intensive production, the productivity gap, wherein larger firms save labor and adopt a more skilled workforce, could widen further.

Our findings suggest that policies that facilitate firms hiring low-skilled immigrants, such as easing restrictions on residency status, provide SMEs with an incentive to continue labor-intensive production and discourage R&D investment, which would improve productivity. As long as there is a trade-off between accepting low-skilled immigrants and increasing R&D investment, we will need to choose between easing restrictions on low-skilled workers to meet the demand of SMEs suffering from a labor shortage and restricting the hiring of low-skilled immigrants to increase productivity. When considering immigration policy, it is therefore important to consider the quality of the labor market that the host country should aim for.

There are questions that this analysis does not address. It would be necessary to demonstrate whether the findings for Japan presented in this study are applicable to other countries. A comparative analysis may reveal that the labor-intensive tendency of SMEs is unique to Japan. In that case, the SMEs' labor-intensive orientation could be interpreted as a factor related to the stagnation of the Japanese economy since the 1990s. In addition, our one-shot cross-sectional survey data, which features no time series information or exogenous events, is insufficient for examining the clear causality between global competition and immigrant employment. To address this issue, future studies should conduct an in-depth analysis of the effect of global competition on immigrant employment and R&D investment using a detailed extensive panel dataset.

[12] According to the Financial Statement Statistics of Corporations by Industry (by Japan's Ministry of Finance), the number of people generating 100 million yen of value added has consistently been 2–2.5 times higher between SMEs (with capital less than 100 million yen) and large firms (with capital greater than 1 billion yen) from 1990 to 2010.

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Table 1 — Summary Statistics for Observations

Variable	Obs	Mean	SD	Min	Max
Dummy for perceived global competition	602	0.140	0.347	0	1
Dummy for difficulty in retaining young workers	602	0.336	0.473	0	1
Dummy for planned future R&D increase	539	0.505	0.500	0	1
Capital stock (ten thousand yen)	601	6,359	12,052	500	140,000
Firm age (years)	587	36.83	14.41	5	55
Number of employees	526	79.96	92.54	1	1,100
Union dummy	585	0.576	0.495	0	1
Initial monthly salary (five years ago, ten thousand yen)	382	14.82	2.472	10	32
Initial wage growth	376	0.0963	0.0708	-0.329	0.371
Dummy for shortage of production workers	419	0.387	0.488	0	1
Non regular workers ratio	519	0.119	0.163	0	1
Female workers ratio	476	0.265	0.199	0	1
Production workers ratio	476	0.551	0.270	0	1

Table 2 — Marginal Effects of Perceived Global Competition on Future Strategy

	Dep. var.: Immigrant employment plan				Dep. var.: Increased R&D investment plan			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Perceived global competition	0.0680**	0.103*	0.109**	0.0987*	-0.159**	-0.206***	-0.198***	-0.211***
	(0.0336)	(0.0534)	(0.0533)	(0.0543)	(0.0634)	(0.0663)	(0.0690)	(0.0661)
Log of capital stock	-0.00578	-0.0259	-0.0253	-0.0286	-0.0542**	-0.0456	-0.0411	-0.0472
	(0.0161)	(0.0233)	(0.0237)	(0.0238)	(0.0271)	(0.0325)	(0.0324)	(0.0328)
Firm age	0.00167*	0.00236	0.00232	0.00250	0.000471	0.000894	0.000834	0.00101
	(0.00095)	(0.0018)	(0.0018)	(0.0018)	(0.0017)	(0.0021)	(0.0021)	(0.0022)
Log of number of employees	0.0300	0.0664**	0.0673*	0.0666*	0.0631*	0.0246	0.0304	0.0220
	(0.0186)	(0.0338)	(0.0346)	(0.0346)	(0.0323)	(0.0393)	(0.0394)	(0.0397)
Union dummy	-0.0332	-0.0131	-0.00790	-0.0133	0.00269	-0.0477	0.000961	-0.0337
	(0.0279)	(0.0517)	(0.0525)	(0.0539)	(0.0496)	(0.0618)	(0.0595)	(0.0624)
City FE	✓	✓	✓	✓	✓	✓	✓	✓
Industry FE	✓	✓	✓	✓	✓	✓	✓	✓
Log of initial monthly salary (five years ago)		✓		✓		✓		✓
Growth rate of initial monthly salary			✓	✓			✓	✓
Number of observations	424	215	210	210	481	338	333	333

Notes: All regressions are logit models. Standard errors are in parentheses. The dependent variable in columns (1)–(4) is the binary variable for whether the firm is an FH firm. The dependent variable in columns (5)–(8) is the binary variable for whether the firm will increase their future R&D investment. "Perceived global competition" is the binary variable on whether a firm is currently realizing increased competition from overseas. *** p<0.01, ** p<0.05, * p<0.1.

Table 3 — Marginal Effects of IPR on Future Strategy

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A	Dep. var.: Immigrant employment plan				Dep. var.: Increased R&D investment plan			
IPR	-0.00171	-0.00139	-0.00139	-0.00154	0.00129	0.000887	0.00180	0.000719
	(0.00122)	(0.00163)	(0.00165)	(0.00168)	(0.00219)	(0.00268)	(0.00268)	(0.00269)
Number of observations	491	317	311	311	481	338	333	333
Panel B								
Exportation dummy	0.0599*	0.0889	0.0924*	0.0870	0.0253	0.0170	0.0315	0.0238
	(0.0325)	(0.0556)	(0.0555)	(0.0566)	(0.0496)	(0.0598)	(0.0609)	(0.0598)
Number of observations	411	211	206	206	474	331	326	326

Notes: All regressions are logit models. Standard errors are in parentheses. The dependent variable in columns (1)–(4) is the binary variable for whether the firm is an FH firm. The dependent variable in in columns (5)–(8) is the binary variable whether the firm will increase their future R&D investment. IPR is import penetration ratio by industry. All specifications include log of capital stock, firm age, log of number of employees, union dummy, city fixed effects and industry fixed effects, log of initial month salary (five years ago) in columns (2), (4), (6) and (8), growth rate of initial monthly salary in columns (3), (4), (7) and (8) as controls (full results not reported to save space). *** p<0.01, ** p<0.05, * p<0.1.

Table 4 — Firm Heterogeneity in Organizational Choices

	Dep. var: Immigrant employment plan				Dep. var: Increased R&D investment plan			
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Panel A								
Perceived global competition	-0.733	-0.754	-0.498	-0.768	-0.557	-0.545	-0.414	-0.545
	(1.094)	(1.203)	(1.164)	(1.191)	(0.448)	(0.516)	(0.511)	(0.514)
(Perceived global competition)	2.679**	3.300**	2.965**	3.174**	-0.214	-0.471	-0.602	-0.474
* (production workers ratio above median)	(1.266)	(1.405)	(1.363)	(1.415)	(0.602)	(0.688)	(0.687)	(0.686)
Number of observations	327	192	188	188	410	289	285	285
Panel B								
Perceived global competition	1.402**	1.825***	1.857***	1.767**	-0.592	-0.692	-0.601	-0.708
	(0.603)	(0.670)	(0.699)	(0.690)	(0.395)	(0.457)	(0.462)	(0.460)
(Perceived global competition)	-1.730	-2.020	-2.066	-2.041	-0.178	-0.782	-0.794	-0.744
* (shortage of production workers dummy)	(1.329)	(1.575)	(1.491)	(1.529)	(0.632)	(0.772)	(0.766)	(0.775)
Number of observations	267	171	168	168	375	264	261	261
Panel C								
Perceived global competition	1.084	1.009	1.084	0.998	-1.205**	-1.274***	-1.203**	-1.281***
	(0.710)	(0.716)	(0.707)	(0.723)	(0.482)	(0.469)	(0.482)	(0.470)
(Perceived global competition)	-0.0124	-0.0262	-0.0130	-0.0350	0.625	0.669	0.634	0.663
* (initial wage growth above median)	(1.033)	(1.041)	(1.032)	(1.041)	(0.662)	(0.659)	(0.664)	(0.656)
Number of observations	210	210	210	210	311	311	311	311

Notes: All regressions are logit models. Standard errors are in parentheses. The dependent variable in columns (1)–(4) is the binary variable for whether the firm is an FH firm. The dependent variable in columns (5)–(8) is the binary variable for whether the firm will increase their future R&D investment. "Perceived global competition" is the binary variable on whether a firm is currently realizing increased competition from overseas. The measure of production workers ratio is the percentage of production workers in a firm. The variable of shortage of production workers is the binary variable for the current shortage of native production workers. The measure of the initial wage growth rate is defined as the ratio of initial wage change from 5 years ago to the present. All specifications include log of capital stock, firm age, log of number of employees, union dummy, city fixed effects and industry fixed effects, log of initial month salary (five years ago) in columns (2), (4), (6) and (8), growth rate of initial monthly salary in columns (3), (4), (7) and (8) as controls (full results not reported to save space). *** p<0.01, ** p<0.05, * p<0.1.

Table 5 — Correlation between Globalization and Workers' Retention

	(1)	(2)	(3)	(4)
Panel A	Dep. var.: Difficulty in young workers' retention			
Perceived global competition	0.109**	0.142**	0.135**	0.136**
	(0.0555)	(0.0657)	(0.0659)	(0.0661)
Number of observations	528	354	348	348
Panel B	Dep. var.: Difficulty in young workers' retention			
IPR	0.0420	0.0472	0.0460	0.0471
	(0.0359)	(0.0471)	(0.0470)	(0.0473)
Number of observations	528	354	348	348

Notes: All regressions are logit models and shows marginal effects. Standard errors are in parentheses. "Difficulty in young workers' retention" is a dummy for whether a firm suffers from difficulty in retaining young native workers. "Perceived global competition" is the binary variable on whether a firm is currently realizing increased competition from overseas. IPR is import penetration ratio by industry. All specifications include log of capital stock, firm age, log of number of employees, union dummy, city fixed effects and industry fixed effects, log of initial month salary (five years ago) in columns (2) and (4), growth rate of initial monthly salary in columns (3) and (4) as controls. (full results not reported to save space). *** p<0.01, ** p<0.05, * p<0.1.

Table 6 — Marginal Effects of Perceived Global Competition and Workers' Retention on Future Strategy

	(1)	(2)	(3)	(4)
Panel A	Dep. var.: Immigrant employment plan			
Perceived global competition	0.0482	0.0632	0.0732	0.0603
	(0.0301)	(0.0478)	(0.0473)	(0.0487)
Difficulty in young workers' retention	0.101***	0.140***	0.139***	0.139***
	(0.0277)	(0.0431)	(0.0433)	(0.0433)
Number of observations	424	215	210	210
Panel B	Dep. var.: Increased R&D investment plan			
Perceived global competition	-0.166***	-0.214***	-0.204***	-0.219***
	(0.0627)	(0.0663)	(0.0687)	(0.0661)
Difficulty in young workers' retention	0.0578	0.0485	0.0426	0.0527
	(0.0480)	(0.0581)	(0.0585)	(0.0585)
Number of observations	528	354	348	348

Notes: All regressions are logit models and shows marginal effects. Standard errors are in parentheses. The dependent variable in Panel A is the binary variable for whether the firm is an FH firm. The dependent variable in Panel B is the binary variable whether the firm will increase their future R&D investment. "Perceived global competition" is the binary variable on whether a firm is currently realizing increased competition from overseas. "Difficulty in young workers' retention" is a dummy for whether a firm suffers from difficulty in retaining young native workers. All specifications include log of capital stock, firm age, log of number of employees, union dummy, city fixed effects and industry fixed effects, log of initial month salary (five years ago) in columns (2) and (4), growth rate of initial monthly salary in columns (3) and (4) as controls. (full results not reported to save space). *** p<0.01, ** p<0.05, * p<0.1.

Appendix table A1 — Summary Statistics and t-test for Three Types of Firms

	FH firms	NH firms	AH firms	P-Value from t-test		
				FH vs NH	AH vs FH	AH vs NH
Dummy for perception of global competition	0.238	0.158	0.263	0.052	0.330	0.740
	(0.436)	(0.365)	(0.452)			
Dummy for difficulty in retaining young workers	0.619	0.324	0.316	0.000	0.070	0.258
	(0.498)	(0.469)	(0.478)			
Dummy for planned future R&D increase	0.667	0.514	0.474	0.045	0.647	0.217
	(0.483)	(0.501)	(0.513)			
Capital stock (ten thousand yen)	4238.1	6948.2	12078.9	0.369	0.147	0.095
	(2538)	(12735)	(31274)			
Firm age (years)	34.76	37.84	42.63	0.169	0.119	0.412
	(15.77)	(14.92)	(10.19)			
Number of employees	89.76	91.80	108.9	0.531	0.423	0.151
	(71.19)	(107.2)	(71.66)			
Union dummy	0.619	0.662	0.737	0.981	0.324	0.191
	(0.498)	(0.474)	(0.452)			
Initial monthly salary	14.92	14.77	14.52	0.923	0.405	0.313
(five years ago, ten thousand yen)	(1.768)	(2.431)	(1.377)			
Initial wage growth	0.0720	0.0988	0.0975	0.221	0.233	0.803
	(0.0618)	(0.0688)	(0.0592)			
Dummy for shortage of production workers	0.333	0.365	0.579	0.813	0.324	0.122
	(0.483)	(0.482)	(0.507)			
Non regular workers ratio	0.0749	0.112	0.146	0.798	0.071	0.027
	(0.0820)	(0.147)	(0.143)			
Female workers ratio	0.264	0.250	0.256	0.263	0.315	0.770
	(0.214)	(0.174)	(0.138)			
Production workers ratio	0.586	0.584	0.582	0.618	0.870	0.800
	(0.185)	(0.220)	(0.243)			
Observations	47	555	40	--	--	--

Notes: Standard deviations are in parentheses. An FH firm is defined as a firm that has not employed immigrant workers at the time of the survey but is willing to employ them in the future. An NH firm is defined as a firm that has neither hired immigrants at the time of the survey nor plans to hire them going forward. An AH firm is defined as a firm that has already employed immigrant workers at the time of the survey.

Appendix table A2 — Summary Statistics and t-test for Future R&D Plan

	Increase in R&D	Not increase in R&D	t-test P-value
Dummy for perception of global competition	0.217	0.117	0.019
	(0.414)	(0.323)	
Dummy for difficulty in retaining young workers	0.339	0.359	0.397
	(0.475)	(0.482)	
Dummy for immigrant employment plan	0.0609	0.109	0.045
	(0.240)	(0.313)	
Capital stock (ten thousand yen)	7321.7	6168.0	0.879
	(10521.7)	(13576.9)	
Firm age (years)	39.13	36.17	0.531
	(14.30)	(15.50)	
Number of employees	90.25	92.85	0.186
	(74.23)	(125.9)	
Union dummy	0.687	0.633	0.765
	(0.466)	(0.484)	
Initial monthly salary	14.94	14.65	0.046
(five years ago, ten thousand yen)	(2.212)	(2.519)	
Initial wage growth	0.0924	0.100	0.297
	(0.0664)	(0.0705)	
Dummy for shortage of production workers	0.348	0.375	0.026
	(0.478)	(0.486)	
Non regular workers ratio	0.121	0.0982	0.374
	(0.172)	(0.109)	
Female workers ratio	0.234	0.267	0.640
	(0.174)	(0.180)	
Production workers ratio	0.576	0.592	0.598
	(0.214)	(0.219)	
Observations	293	281	--

Notes: Standard deviations are in parentheses.

Appendix table A3 － IPR by Industrial Sector, 1996

Industrial sector	IPR
Food	22.18
Textile mill products	20.89
Lumber and wood products	24.21
Pulp, paper and paper products	12.78
Printing and allied industries	1.29
Plastic and rubber products	28.44
Ceramic, stone and clay products	6.1
Iron and steel	12.29
Non-ferrous metals and products	68.18
Fabricated metal products	3.15
General-purpose machinery	10.75
Electrical machinery, equipment and supplies	28.76
Transportation equipment	14.39
Electronic parts, devices and electronic circuits	21.95
Miscellaneous manufacturing industries	25.78

Notes: The source of data is RIETI JIP database.