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【要旨】

本論文では日本の製造業において情報通信技術（ICT）とオフショアリングがスキル需要に及ぼす影響を検証する．論文の貢献は，パートタイム労働者に対する労働需要に焦点を当てたことにある．主要な結果は次の二点である．第一に，ICT 資本ストックの大きい産業では労働需要が中低スキル労働者から中高スキルおよびパートタイム労働者にシフトしていることである．第二に，オフショアリングの拡大は高スキル労働者への需要の増加に結びつく一方で，中高・中低スキル労働者，及びパートタイム労働者への需要には影響を与えるとは言えないことである．これらの結果は，日本においては，ICT の拡大がパートタイム労働者への需要を増加させていることを示唆するものである．

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ICT, Offshoring, and the Demand for Part-time Workers: The Case of Japanese Manufacturing*

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Abstract

This paper examines the effects of information and communication technology (ICT) and offshoring on the skill demand in Japanese manufacturing. One of the contributions of this paper is that we focus explicitly on the demand for low-wage part-time workers, which we call low skilled workers. Estimating a system of variable factor demands for the period 1980–2011, we found that industries with higher ICT stock shifted demand from middle-low to middle-high *and* low skilled workers. Offshoring is associated with the increasing demand for high skilled workers but it has insignificant effects on the demand for middle-high, middle-low, and low skilled workers. The results together suggest that the increasing demand for low-wage part-time workers can be attributable to ICT in Japan.

Key words: Labor Demand; Part-time Workers; Offshoring; Information and Communication Technology; Skills
JEL classification codes: F14; J31

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1 Introduction

With the growing demand for skilled workers relative to unskilled workers, the wage inequality between skilled and unskilled workers is increasing in many countries. Theoretically, the increases in the relative demand for skilled workers can be explained by both offshoring and skill-biased technological change due to the use of computers and other high-tech equipment (Feenstra, 2010).[1] Determining which of these explanations account for the changes in demand is an empirical question.[2] Accordingly, several studies have examined the effects of skill-biased technological change and offshoring on skill demand.

Along with this line of the literature, this paper examines the effects of information and communication technology (ICT) and offshoring on the skill demand in Japanese manufacturing, focusing on the difference between full-time workers and part-time workers. In Japan, the focus of this paper, the demand for part-time workers as well as full-time workers is a growing concern in recent years. This is mainly due to the large wage gap between full-time workers and part-time workers. For example, in their interim report, the investigation committee of the labor relations issues in the Liberal Democratic Party pointed out that the wage gap between full-time and part-time workers in Japan was larger than that in European countries.[3] The Liberal Democratic Party thus is attempting to narrow the wage gap by introducing a policy of equal pay for equal jobs. This in turn generates considerable debate among policy makers as well as among academic researchers.

Our motivation for this research comes from three strands of the literature. The first strand is composed of studies that estimate the system of labor demands, controlling for the

[1]Throughout this paper, we abuse terminology and freely interchange the terms "international (or foreign) outsourcing" and "offshoring," as has been the practice in the empirical studies on this issue although, strictly speaking, they are slightly different concept. For more detail, see (Feenstra, 2010, pp.5–6).

[2]See Berman et al. (1998) and Feenstra and Hanson (1999) for the theoretical explanation on the effects of offshoring and skill-biased technological change on the relative labor demand (and relative wages).

[3]Interim reports on 'a policy of equal pay for equal jobs' for 'a better deal for non-regular workers' ('Hiseiki Koyou no Taigu no Kaizen' no tameno 'Douitsu Roudou Douitsu Chingin'), by the investigation committee of the labor relations issues in the Liberal Democratic Party, April 8th, 2016.

effects of skill-biased technological change and offshoring simultaneously.[4] This approach was first proposed by Hijzen et al. (2005) which examined the skill demand in the United Kingdom. Ahn et al. (2008) applied this framework to Japan and Korea.[5] Using detailed industry data in Japan and Korea between 1988 and 2002, they found that the labor demand shifted to skilled workers in Japanese manufacturing due to offshoring.

Their study did not focus explicitly on low-wage part-time workers although their study contributes to the literature. As we will see in Section 3, the average wages of the Japanese manufacturing workers can be classified into four groups: 1) university graduates; 2) college or high school graduates; 3) junior-high school graduates; and 4) part-time workers. Because the share of part-time workers is increasing while the growth of their wages remains low, including part-time workers is important in the context of the Japanese labor market.

The second strand of the literature is the studies of part-time workers. Several studies examined the supply and wages of part-time workers in Japan. However, only a few studies focused on the demand for them. An example of such a study is Gaston and Kishi (2007). One of their research questions is why firms *increasingly* employ part-time workers in jobs traditionally offered to full-time workers. Using the establishment data for the period between 1999 and 2001, they found that "manufacturing firms are outsourcing in lieu of hiring domestic part-time workers" (p.435). Although their study presented interesting findings, their study did not control for the effect of technological change. Besides, it is not clear why the demand for part-time workers *increased* rather than *decreased*, despite the fact that manufacturing firms increased outsourcing.

The third strand is the studies that investigate the determinants of demand for non-

[4]Another approach is to estimate a single cost function rather than the system of cost functions. See, for example, Sasaki and Sakura (2005) and Yamashita (2008). This paper focuses on the system of cost functions because the demand for skilled and unskilled workers is determined simultaneously.

[5]A more recent study by Foster-McGregor et al. (2013) examined the labor demand for 40 countries, including Japan. However, because their main interest is on the cross-country comparisons, they did not focus explicitly on Japan.

regular or temporary workers in Japan. For example, Asano et al. (2013) examined the effects of ICT on non-regular workers,[6] using firm-level data for the period between 1998 and 2006 in Japan. In their study, non-regular workers are the sum of part-time workers and temporary workers. The part-time workers are workers who work shorter hours or days than regular workers. The temporary workers are defined as workers who were hired under a contact that extends one month or shorter. Using firm-level data, they found that the introduction of ICT increased firms' usage of non-regular workers. However, their study did not control for the effects of offshoring.[7] A more recent study by Tanaka (2016) examined the effects of offshoring on the demand for temporary workers, using firm-level data in Japan for the period between 2001 and 2007. His study found that offshoring increased the demand for temporary workers. However, his study did not control for the effects of ICT. Moreover, neither Asano et al. (2013) nor Tanaka (2016) took into account the difference of skills.

Building upon these three strands of literature, this paper examines the effects of offshoring and skill-biased technological change on skill demand in Japanese manufacturing. Our study extends the previous studies in four ways. First, our study utilized a more detailed skill classification than that of previous studies. Specifically, we focus explicitly on low-wage part-time workers, which we define as the workers whose average number of hours worked in a week is less than 35.[8] To the best of our knowledge, our focusing on the part-time workers is the first attempt in the literature to integrate the effects of offshoring and skill-biased technological change on skill demand.

Second, this paper improves the measurement of skill-biased technological change. Several studies including Ahn et al. (2008) utilized R&D expenditure for the proxy of skill-biased

[6]Asano et al. (2013) called non-regular workers as nonstandard workers.

[7]Similarly, Ikenaga (2009) found that the ICT complemented workers with non-routine analytic tasks while substituting them with routine tasks. However, her study also did not take into account the effects of offshoring.

[8]Note that 44 percent of non-regular workers work more than 35 hours per week in 2008 (Asano et al., 2013, Table 1). Full-time workers in this paper are not necessarily regular workers.

technological change.[9] However, R&D expenditure is not necessarily an appropriate proxy the use of computers or other high-tech equipment. One of the reasons is that R&D expenditure is generally measured by flow while computer equipment is measured by stock. Theoretically, the inputs of the production function should be measured by stock. If R&D is measured by flow, the accumulation of experience and knowledge from R&D in the previous years will be ignored completely. To overcome this problem, a more recent study by Michaels et al. (2014) utilized ICT stock as a proxy for skill-biased technology change. ICT stock is a more appropriate proxy for skill-biased technological change because it includes both computers and other high-tech equipment and it is measured by stock. Following Michaels et al. (2014), we utilize ICT capital stock as a proxy.[10]

Third, we tested various measures of offshoring to check the robustness of the results.[11] This allows us to enhance the credibility of our analysis. Finally, our study covers a longer period (i.e., from 1980 to 2011) than that of other studies, including more recent years. Our study presents a comprehensive picture of the Japanese manufacturing for the last 30 years. Moreover, our study is the latest update of the studies on the effects of ICT and offshoring on the skill structure in Japan.

The rest of the paper is organized as follows. Section 2 describes the empirical framework. Section 3 explains the data used in this paper. In Section 4, we present the estimation results. We check the robustness of our results in Section 5. A summary and concluding remarks are presented in Section 6.

[9] Foster-McGregor et al. (2013) utilized industry-country specific time trend to control for the effect of technological change.

[10] Michaels et al. (2014) also examined the effects of offshoring and skill-biased technological change for 11 countries, including Japan. However, their analysis is based not on system but on a single factor demand function.

[11] Note that Michaels et al. (2014) applied the US import-use matrix in 1987 to other countries in other years. This is a problem because the import-use structure is basically assumed to be constant over the period. We relax this assumption in our empirical analysis, allowing for the changes in import-use matrix over the period.

2 Econometric Methodology

2.1 Model

Let i be the index of industry ($i = 1, ..., N$); j be the index of factor ($j = 1, ..., J$); k be the index of fixed input or output ($k = 1, ..., K$); and r be the index of proxy for technological change ($r = 1, ..., R$). For the ease of presentation, we omit time subscript t, unless otherwise noted. As in Berndt (1991), assume that the industry cost function can be represented by a translog form, which is twice differentiable, linearly homogenous, and concave in factor prices. The cost function of industry i, C_i, can be represented as follows:

$$\ln C_i(w, x, z) = \alpha_0 + \sum_{j=1}^{J} \alpha_j \ln w_{ij} + \sum_{k=1}^{K} \beta_k \ln x_{ik} + \sum_{r=1}^{R} \gamma_r z_r$$
$$+\frac{1}{2}\sum_{j=1}^{J}\sum_{s=1}^{J} \alpha_{ij} \ln w_{ij} \ln w_{is} + \frac{1}{2}\sum_{k=1}^{K}\sum_{l=1}^{K} \beta_{kl} \ln x_{ik} \ln x_{il} + \frac{1}{2}\sum_{r=1}^{R}\sum_{q=1}^{R} \gamma_{rq} z_{ir} z_{iq}$$
$$+\frac{1}{2}\sum_{j=1}^{J}\sum_{k=1}^{K} \delta_{jk} \ln w_{ij} \ln x_{ik} + \frac{1}{2}\sum_{j=1}^{J}\sum_{r=1}^{R} \delta_{jr} \ln w_{ij} z_{ir} + \frac{1}{2}\sum_{k=1}^{K}\sum_{r=1}^{R} \delta_{kr} \ln x_{ik} z_{ir}, \quad (1)$$

where w_{ij} is factor price for factor j in industry i; x_{ik} is fixed input or output k in industry i; z_{ir} is other exogenous factor r such as technological change.

Assume the constant returns to scale technology. The variable cost function is then linearly homogeneous in variable factor prices:

$$\sum_{j=1}^{J} \alpha_j = 1 \text{ and } \sum_{j=1}^{J} \alpha_{js} = \sum_{s=1}^{J} \alpha_{sj} = \sum_{j=1}^{J} \delta_{jk} = \sum_{j=1}^{J} \delta_{jr} = 0. \quad (2)$$

Without loss of generality, symmetry implies $\alpha_{js} = \alpha_{sj}$. Let v_{ij} be the variable input j in industry i. Differentiating the translog cost function with respect to factor prices, we have the cost share of factor j in total variable costs:

$$S_{ij} = \alpha_j + \sum_{s=1}^{J} \alpha_{js} \ln w_{ij} + \sum_{k=1}^{K} \delta_{jk} \ln x_{ik} + \sum_{r=1}^{R} \alpha_{jr} z_{ir}, \tag{3}$$

where $S_{ij} = \partial \ln C_i / \partial \ln w_{ij} = (w_{ij}/C_i)(\partial C_i/\partial w_{ij}) = w_{ij} v_{ij}/C_i$ and $\sum_{j=1}^{J} S_{ij} = 1$.

Adding time subscript t and error term μ_{ijt} and taking into account the industry-factor specific fixed effects α_{ij}, regression equation is written as:

$$S_{ijt} = \alpha_{ij} + \sum_{j=1}^{J} \alpha_{js} \ln w_{ijt} + \sum_{k=1}^{K} \delta_{jk} \ln x_{ikt} + \sum_{r=1}^{R} \alpha_{jr} z_{irt} + d_{jt} + T_{jt} + \mu_{ijt}. \tag{4}$$

Following Hijzen et al. (2005), we use labor inputs as well as intermediate inputs as for variable factors. The detailed classification of labor inputs is defined in the next section. For fixed inputs x_{ikt}, we use the non-ICT capital stock. For z_{irt}, we utilize offshoring and the ICT capital stock. A full set of time dummies d_{jt} is included to capture the economy-wide shocks. Factor-specific time trend T_{jt} is also included to control for some of the effects of factor supply j (e.g., the declining supply of junior-high school graduates).

2.2 Elasticities

Without a loss of generality, remove industry subscript i and time subscript t for the ease of the exposition. The cost share of factor j is written as S_j. The elasticity of factor demand j with respect to a change in factor prices is:

$$\varepsilon_{js} = \frac{\partial \ln v_j}{\partial \ln w_s} = \frac{\hat{\alpha}_{js}}{S_j} + S_s - \phi_{js}, \tag{5}$$

where $\phi_{js} = 1$ if $j = s$ and $\phi_{js} = 0$ if $j \neq s$, $\sum_{j=1}^{J} \varepsilon_{js} = 0$, and $\hat{\alpha}_{js}$ is an estimated parameter value in equation (4). The elasticity of factor demand j with respect to a change in non-ICT capital stock or output is:

$$\varepsilon_{jk} = \frac{\partial \ln v_j}{\partial \ln x_{sk}} = \frac{\hat{\delta}_{jk}}{S_j}, \tag{6}$$

where $\sum_{j=1}^{J} \varepsilon_{jk} = 1$ and $\hat{\delta}_{jk}$ is an estimated parameter value in equation (4). The elasticity of factor demand with respect to skill-biased technological change due to offshoring is:[12]

$$\varepsilon_{jr} = \frac{\partial \ln v_j}{\partial z_r} = \frac{\hat{\alpha}_{jr}}{S_j}, \tag{7}$$

where $\sum_{j=1}^{J} \varepsilon_{jr} = 1$ and $\hat{\alpha}_{jr}$ is an estimated parameter value in equation (4).

3 Trends in Labor Markets, ICT, and Offshoring in Japan

3.1 Data

Outputs and inputs

Data on outputs, inputs, and their prices are obtained from the Japan Industrial Productivity database 2014 (JIP database 2014), which was compiled as part of a research project at the Research Institute of Economy, Trade and Industry (RIETI). The database is constructed to estimate total factor productivity (TFP). The database includes detailed information on sectoral outputs, inputs, and their prices. The database runs annually from 1970 to 2011, consisting of 52 manufacturing and 56 nonmanufacturing industries.[13]

From the JIP database 2014, we use gross outputs, ICT capital stock, non-ICT capital stock, intermediate inputs, labor inputs, and labor costs for manufacturing industries.[14] In

[12] Following Hijzen et al. (2005), we call ε_{jk} and ε_{jr} as elasticities.

[13] The database is downloadable from `http://www.rieti.go.jp/en/database/JIP2014/index.html` For more details about the JIP database, see Fukao et al. (2007).

[14] ICT capital stock and non-ICT capital stock are used as fixed inputs because the user cost of capital is not available by the type of capital. Besides, it is common to assume that capital is (quasi-)fixed input in

the JIP database, the ICT capital stock is estimated following the guidelines of the OECD. The ICT capital stock consists of 39 assets such as electric computing equipment, wired and radio communication equipment, and applied electronic equipment.[15] Other assets are classified as non-ICT capital stock. All of these variables are valued at constant prices (year 2000). We also obtain nominal intermediate inputs from the database to compute the cost shares.

The labor inputs consist of the following six categories: 1) university graduates or higher; 2) college graduates; 3) high school graduates; 4) junior high school graduates; 5) part-time workers; and 6) self-employed workers. The educational level of the last two categories is not available. In the JIP database, the part-time workers are defined as the workers whose average number of hours worked in a week is less than 35 hours.[16] The labor costs are the sum of monthly wages plus bonuses. The average wages are obtained from the labor costs divided by the product of the number of workers and hours worked.

Figure 1 presents the disparities in average wages per hour across the above six worker categories in Japanese manufacturing in 1980 and 2011. Each category is represented by a horizontal line segment, the length of which indicates the worker share of the labor force. The average hourly wage is indicated by the vertical position.

=== Figure 1 ===

There are three notable findings. First, the average wages are different across educational level and worker types. Figure 1 indicates that, in 2011, the workers can be classified into four groups: 1) high wage category that consists of university graduates (4,159 JPY); 2) middle-high wage category that consists of high school and college graduates (2,954 JPY

estimating a production function. See, for example, Kiyota et al. (2009) and Dobbelaere et al. (2015) for the case of Japanese firms.

[15]Because the JIP database follows the coverage of Japanese 93 Social and National Accounts, own-account software and prepackaged software are not included in ICT capital stock.

[16]The coverage of the non-regular workers is wider than that of the part-time workers because some of the non-regular workers works more than 35 hours per week.

and 2,859 JPY, respectively); 3) middle-low wage category that consists of junior-high school graduates (2,320 JPY); and 4) low wage category that consists of part-time workers and self-employed workers (923 JPY and 792 JPY, respectively). The average wages of part-time and self-employed workers is less than half of that of junior-high school graduates. Difference between college/high school graduates and junior-high school graduates is also not negligibly small in 2011.

Second, the share of part-time workers in manufacturing employment expanded significantly. The employment share of part-time workers grew from 7.7 percent in 1980 to 17.7 percent in 2011.[17] Noting that the share of university graduates was 18.5 percent in 2011, the size of part-time workers is not negligible in Japanese manufacturing employment.[18]

Third, both the share of the highest wage category (i.e., university graduates) and that of the lowest wage categories (i.e., self-employed and part-time workers) increased from 1980 to 2011. On the flipside, the share of the middle wage categories (i.e., college, high-school, and junior high-school graduates) declined over the period. This result may imply the "job polarization" of the labor market, where there is a simultaneous growth of high-education, high-wage jobs at one end and low-education, low-wage jobs at the other end, both at the expense of middle-wage, middle education jobs (Goos and Manning, 2007).

Figure 2 presents the average wage per hour, by above six categories from 1970 to 2011. The wage is valued at current prices. We highlight two results. First, the average hourly wages of part-time and self-employed workers are almost constant from the early 1990s even though that of junior-high school graduates grew in the 1990s (and gradually decline afterward). Assuming that the average hourly wages reflect the marginal product of labor, these results imply that the part-time and self-employed workers are different from other worker categories. Combining the part-time and self-employed workers with other worker

[17]Figure A1 presents the share of workers, by education and type of workers from 1970 to 2011 in more detail.

[18]Table A1 presents the share of part-time workers between 1980 and 2011, by industry.

categories would thus be a problem in analyzing the skill demand in Japanese manufacturing.

=== Figure 2 ===

Second, the wage gap between college/high school graduates and junior-high school graduates starts expanding from the 2000s. The average wage of junior-high school graduates was almost the same as that of college and high-school graduates from 1990 to 2000, but it gradually declined from 2000. As a result, the average wage of junior-high school graduates was 20 percent lower than that of college/high school graduates in 2011. This result also implies that it is important to cover the 2000s to examine the recent expansion of wage gap between college/high school graduates and junior-high school graduates.

Note that self-employed workers are employer rather than employee. It is not clear whether the demand for employers can be estimated in the same framework as the demand for employees. Note also that the skills required to part-time workers are generally lower than the skills required to full-time workers. According to Japan Institute for Labour Policy and Training (JILPT) (2008, Figure 8-1-1), jobs that firms assign to non-regular workers, including part-time workers, are those that require only one-week experience or training, regardless of the educational background of part-time workers. In contrast, jobs that firms assign to regular workers are those that require more than three-year experiences. This implies that the par-time workers' job requires generally lower skills than full-time workers' job.

Based on these observations, this paper classifies labor inputs into four groups: 1) High skilled workers which are defined as university graduates; 2) Middle-high skilled workers which are defined as college or high school graduates; 3) Middle-low skilled workers which are defined as junior-high school graduates; and 4) Low skilled workers which are defined as part-time workers.[19] We exclude self-employed workers from the analysis for the reason noted above.

[19]One may point out that part-time workers are mostly female workers. In 2011, the share of female

One may be concerned that the part-time workers are not necessarily low education workers. According to Ministry of Health and Welfare (2010), however, 56.6 percent of part-time workers are either junior-high school or high school graduates in 2010. Only 12.4 percent of the part-time workers are university (or graduate school) graduates. Together with the fact that the part-time workers earn low wages, this paper classifies them as low skilled workers.

Offshoring

The offshoring is computed using import-use matrices of input–output tables for manufacturing industries between 1980 and 2011.[20] The input–output table is available every five year between 1980 and 2005, and 2011 (i.e., 7 years: 1980, 1985, 1990, 1995, 2000, 2005, and 2011). Unlike Michaels et al. (2014) that applied the US import-use matrix in 1987 to other countries in other years, we allow the import-use matrix changes over the period.[21]

There are two types of offshoring in the literature. One is the narrow offshoring $S^N_{O,it}$ and the other is the broad offshoring $S^B_{O,it}$. The narrow offshoring is defined as the imported intermediate inputs in an industry i from the same industry (which corresponds to diagonal terms of the import-use matrix) divided by the industry i's tradable intermediate inputs M_{ijt}:

$$S^N_{O,it} = \frac{O_{ii,t}}{\sum_{j=\text{tradables}} M_{ijt}}, \tag{8}$$

where $O_{ii,t}$ stands for imported intermediate inputs in industry i in year t only; and M_{ijt} is

workers in part-time workers was 57 percent in 2011. The share of female workers in part-time workers is declining in recent years, implying that the male part-time workers are increasing. Our companion paper, Kiyota and Maruyama (2016), examined the effects of ICT and offshoring on the labor demand, focusing on the difference between female and male workers.

[20] The construction of the import-use matrices are explained in the Appendix.

[21] Note that the import-use matrix is not available in every year in many countries. Some studies such as Hijzen et al. (2005) and Ahn et al. (2008) employed linear extrapolation (or interpolation) for the missing years to fill the gaps. In this paper, however, we do not employ the linear extrapolation (or interpolation). The changes in imports seemed to be non-linear because the missing years include such years as the Asian financial crisis in 1997 and the global financial crisis in 2008–09.

intermediate inputs from industry j to industry i in year t.[22] Tradable intermediate inputs mean both domestic and imported intermediate inputs from agricultural and manufacturing industries.[23] Feenstra and Hanson (1999) refered to this measure of offshoring as the narrow measure of offshoring.[24]

The broad measure is defined as all the imported intermediate inputs in an industry i divided by the industry i's total tradable intermediate inputs:

$$S_{O,it}^{B} = \frac{\sum_{j=1}^{J} O_{ijt}}{\sum_{j=\text{tradables}} M_{ijt}}. \tag{9}$$

Feenstra and Hanson (1999) prefer the narrow measure to the broad measure because the essence of fragmentation, which necessarily takes place within the industry, is closer in the narrow measure to the broad measure. In the baseline model of our analysis, we utilize the narrow definition of offshoring. In Section 5, we also use the broad measure to check the robustness of our results.[25]

One may be concerned that offshoring is growing not only in manufacturing but also in services industries (Amiti and Wei, 2005). Even though we recognize the importance of services offshoring, the JIP database is not fine enough to zoom in on those services that are

[22]Note that there is a slight abuse of notation where both i and j stand for industries. To maintain the consistency, M_{ijt} stands for the imported intermediate inputs from industry j to industry i, which is opposite from the standard notation in the input–output analysis.

[23]For some industries such as Seafood products and Livestock products, inputs mainly come from agricultural industries. If we focus on manufacturing intermediate inputs, these industries tend to show high offshoring index because their manufacturing inputs are low. In the baseline model, therefore, we take into account agricultural intermediate inputs. To check the robustness of our results, Section 5 utilizes different measures of denominator.

[24]Strictly speaking, Feenstra and Hanson (1999) utilized non-energy intermediate inputs for the denominator.

[25]The source countries of imported intermediate inputs may be of interest in order to identify imports from low-wage countries. Unfortunately, however, our data do not allow us to decompose the imported intermediate inputs, by country. As reference, we computed the share of imported intermediate inputs, by country, from the World Input-Output Database. The results are presented in Figure A2. Although China presents the largest share, Japan also imports intermediate inputs from high-income countries such as Korea, the United States, Taiwan, and Germany. This result means that Japanese offshoring goes not only toward developing countries but also toward developed countries. Distinguishing the difference between the offshoring toward developing and developed countries is an important issue for future research.

heavily offshored, such as consultancy and accounting services. The lowest level of detail in the JIP database is other services for business, which for the major part contains activities that are not internationally offshored. It may be too abstract to utilize the JIP database for the analysis of services offshoring. In this paper, therefore, we focus on manufacturing industries only.

3.2 Descriptive statistics

Tables 1 and 2 report some summary statistics for the labor market and production data for 1980–2011. Table 1 presents the average cost shares of high skilled, middle-high skilled, middle-low skilled, and low skilled workers (S_H, S_{MH}, S_{ML}, and S_L, respectively) and intermediate inputs (S_M) at the level of the industry (52 manufacturing industries from 1980 to 2011). The major findings are twofold. First, on average, intermediate inputs indicate the largest cost shares, accounting for 77.3 percent of total variable costs. Second, the cost share of the labor inputs varies across groups, ranging from 0.7 percent for low skilled to 12.4 percent for middle-high skilled workers.

=== Tables 1 & 2 ===

Table 2 presents average annual changes for the quantities and prices of inputs and output between 1980 and 2011. Two messages stand out from this table. First, the cost shares were fairly stable over the sample period. The annual percentage change is less than 1 percent for all the cost shares. This result is quite similar to that in the United Kingdom reported in Hijzen et al. (2005). Second, however, some of the input quantities and flexible factor prices indicate a large change. For example, the demand for high skilled workers grew at 1.3 percent per year whereas the demand for the middle-low skilled workers declined at 7.7 percent per year. The average wage grew at around 1.8 percent for low, middle-high, and high skilled workers whereas at 1.6 percent for middle-low skilled workers. As a result, as we confirmed in Figure 1, the wage gap between low skilled and other groups of workers expanded from 1980 to 2011.

Table 3 presents descriptive statistics for broad and narrow offshoring and the share of the ICT capital stock.[26] We also report the difference between the broad and narrow measures. This represents the intermediate inputs from other industries in foreign countries. There are three notable findings. First, the narrow offshoring increased steadily from 2.1 percent in 1980 to 5.7 percent in 2005, although it declined slightly to 5.3 percent in 2011. This implies the increasing importance of offshoring from the mid-1980s. Second, differential and broad offshoring show slightly different trends. Both measures increased steadily throughout the period. This implies that the results of our analysis may be sensitive to the measurement of offshoring. Although we utilize the narrow definition of offshoring in the baseline model in Section 4.2, we examine how the results are sensitive to the measurement of the offshoring in Section 5.

=== Table 3 ===

Finally, the share of the ICT capital stock to total capital stock increased rapidly. The ICT capital share increased from 2.4 percent in 1980 to 15.0 percent in 2011. Because the ICT capital stock and offshoring increased over the period, the increase in the relative demand for skilled labor can be explained by offshoring or skill-biased technological change (or both). We now turn to the econometric analysis.

[26]Tables A2 and A3 present narrow offshoring and the share of ICT capital stock to total capital stock between 1980 and 2011, by industry.

4 Results

4.1 Preliminary analysis

Before going to the detailed analysis on factor demand, it is useful to examine how the demand for part-time workers is different from the demand for full-time workers in order to grasp the overall picture of the labor demand in Japan. As a preliminary analysis, we decompose employees to full-time and part-time workers. Equation is estimated by the group of workers. Therefore, there are two equations to be estimated (for full-time and part-time workers). We denote full-time and part-time workers as L_F and L_L, respectively, and their wages as w_F and w_L, respectively.

The first two columns in Table 4 present the estimation results of equation (4). Due to the symmetry constraint, the coefficients of w_L in L_F equation and w_F in L_L equation are the same. Note also that the demand for each group of workers could be determined simultaneously. We test the null hypothesis that the error terms across equations are contemporaneously uncorrelated, using the Breusch–Pagan test. The null hypothesis is rejected at 1 percent level. Because the error terms across equations are correlated with each other, the system of equations should be estimated by the seemingly unrelated regression (SUR) model. We also test the null hypothesis that the industry-factor fixed effect equals zero, which is rejected at 1 percent level in all equations. This implies that the SUR with fixed effects performs better than the SUR without fixed effect. It is important to control for unobserved industry heterogeneity in estimating labor demand.[27]

=== Table 4 ===

The last three columns in Table 4 present the elasticities of factor demands. The elas-

[27]Considering this relation, one may be concerned about multicollinearity due to the correlation between offshoring and ICT capital. We checked the correlation between narrow offshoring and ICT capital and found that it was 0.176. The relatively low correlation between offshoring and ICT capital suggests that multicollinearity is not a serious problem in our analysis.

ticities are computed, using the estimated parameters and simple average cost shares across industries and years. Five findings are evident from this table. First, all the own price elasticities are negative and statistically significant (in italic in Table 4). This means that a necessary (but not sufficient) condition for concavity in factor prices is satisfied. In other words, the cost functions are well behaved in the sense that they are consistent with standard economic theory (Hijzen et al., 2005, p.870). Second, in both full-time and part-time workers, increases in wages have positive effects on the demand for materials. This implies that labor and material substitute for each other.

Third, the offshoring has insignificant effects on the demand for both full-time and part-time workers. Fourth, the effect of the ICT capital on the demand for part-time workers is significantly positive but it is insignificant for full-time workers. Finally, the effect of non-ICT capital is insignificant for the demand for both full-time and part-time workers.

These results together suggest that neither offshoring nor ICT capital is harmful for the demand for part-time workers. Indeed, ICT capital has significantly positive effects on the demand for part-time workers. However, the effects on full-time workers could be different across skill groups. For example, if some groups of full-time workers have positive effects from offshoring while others have negative effects, these effects may offset each other. As a result, we might find insignificant effects of offshoring on the demand for full-time workers. The next section addresses this issue in more detail.

4.2 Baseline model

This section further decomposes the full-time workers into three groups to examine how offshoring and ICT capital have different effects across groups.[28] We first estimate equation (4). The results are presented in Table A4. Similar to the preliminary analysis, the Breusch–Pagan test rejects the null hypothesis that the error terms across equations are

[28] For the part-time workers, as mentioned above, the information on education is not available.

contemporaneously uncorrelated at 1 percent level. The null hypothesis that the fixed effect equals zero is also rejected at 1 percent level in all equations. We thus report the SUR results with fixed effects.

Table 5 presents the estimated elasticities of factor demands. Five findings are evident from this table. First, the own price elasticities are negative and generally statistically significant (in italic in Table 5). Second, regardless of the groups, increases in wages have positive effects on the demand for materials.

=== Table 5 ===

Third, the offshoring has significantly positive effects on the demand for high skilled workers. However, the effect of offshoring on the demand for low, middle-low, and middle-high skilled workers is insignificant. This result suggests that the offshoring is not harmful for workers although it is complementary only to high skilled workers. The result is consistent with the findings of the previous studies such as Ahn et al. (2008) which found that the labor demand shifted to skilled workers in Japanese manufacturing due to offshoring. The result is also consistent with the findings of the previous studies such as Kambayashi and Kiyota (2015) and Yamashita and Fukao (2010) which found that the negative effects of foreign direct investment on employment were, if any, rather small in Japan.

Fourth, the effect of the ICT capital on the demand for middle-high, middle-low, and low skilled workers is significantly positive, significantly negative, and significantly positive, respectively. This result implies that ICT has different effects across skills: it complements the middle-high *and* low skilled workers but substitutes for the middle-low skilled workers. Industries with higher ICT stock shifted demand from middle-low skilled workers to middle-high skilled and low skilled workers.

The insignificant effect of the ICT capital on the demand for high skilled workers is a bit puzzling. One possible reason may be that the university graduates work at a variety of tasks due to their growing supply and the tight job market in the lost two decades. Some engage in high skilled non-routine tasks but others engage in less skilled routine tasks. Such heterogeneity in the university graduates may offset the effects of the ICT capital with each other.

Finally, the effect of non-ICT capital is significantly positive for the demand for middle-low skilled workers while significantly negative for the demand for middle-high and low skilled workers. The effect of non-ICT capital is insignificant for the demand for high skilled workers. Note that ICT capital has the opposite effect for the demand for middle-high, middle-low, and low skilled workers, the results suggest that non-ICT capital stock offset some of the effects of ICT-capital stock. In other words, the non-ICT capital complements the employment of middle-low skilled workers while substituting that of middle-high and low skilled workers.

In sum, the effects of ICT and offshoring are different across groups. The demand for middle-low skilled workers has negative effects from ICT. The middle-high and low skilled workers have positive effects from ICT while the high skilled workers have benefits from offshoring. Autor (2015) pointed out that "automation and new technology were going to wipe out large numbers of middle class jobs" (p.3). Our result is consistent with this ICT–based "job polarization." A part of the growing demand for part-time workers thus can be explained by the expansion of ICT. As mentioned above, the effects of ICT and offshoring on the demand for part-time workers have not been examined in the previous studies such as Ahn et al. (2008). Our results provide a fresh insight for the discussion on the increasing demand for part-time workers.

5 Robustness Check

In the baseline model, we found that offshoring was not harmful for workers. However, one may be concerned that our results are sensitive to the measurement of the offshoring, sample selection, or additional control variables. This section addresses some of these issues.

5.1 Alternative measures of offshoring

First, one may be concerned that our results are attributed to the measurement of the offshoring variable because the trend of the narrow offshoring is slightly different from that of the broad offshoring (Table 3). To address this concern, we estimate equation (4), replacing the narrow offshoring variable with the broad offshoring. All the other independent variables and the estimation method are the same as the baseline model.

The second rows in Tables 6 and 7 present the estimation results of offshoring elasticity and ICT capital stock elasticity, respectively. Other elasticities are reported in Table A5. The second row in Table 6 indicates that the offshoring has significantly positive effects on the demand for high skilled workers while significantly negative effects on the demand for middle-high skilled workers. There is no significant effect on the demand for middle-low and low skilled workers.

=== Tables 6 & 7 ===

The second row in Table 7 demonstrates that the ICT capital stock has positive effects on the demand for middle-high and low skilled workers whereas it has negative effects on the demand for middle-low skilled workers. No significant effect is confirmed on the demand for high skilled workers. These results suggest that the major messages of the baseline model remain unchanged even when we employ a broad measure of offshoring.

Another concern may be that our results are sensitive to the measurement of the denominator. We use total tradable intermediate inputs as the denominator in the baseline model.

To check the robustness of our results, we use all intermediate inputs and gross output. All the variables and the estimation method are the same as the baseline model (i.e., narrow offshoring).

The third and fourth rows in Tables 6 and 7 present the results of all intermediate inputs and gross output, respectively. Other elasticities are reported in Tables A6 and A7. The results are generally the same as those of baseline results. The effect of offshoring is significantly positive on the demand for high skilled workers although it turns to be insignificant in the case of the use of gross output. The effect of the ICT capital stock is significantly positive for the demand for middle-high and low skilled workers while significantly negative for the demand for middle-low skilled workers. We thus can conclude that the results are generally robust in regards to the measurement of the denominator of the offshoring variable.

5.2 Additional control variable

Michaels et al. (2014) found that the effects of offshoring became insignificant once the initial R&D intensity, measured by R&D expenditure to value added ratio, was controlled for. Because our analysis is based on the fixed effect SUR model, the effects of the industry-specific time-invariant factors such as the initial R&D intensity are absorbed by the fixed effect. Nevertheless, one may be worried about whether the technology change z_{ir} can be attributable to offshoring or ICT, and year fixed effects.

To address this concern, we assume that the technology change z_{ir} depends not only on offshoring or ICT but also on R&D intensity, and estimate the regression equation, adding R&D intensity variable. Due to the difficulty in obtaining R&D stock, following Michaels et al. (2014), we use R&D investment. R&D investment is obtained from the Research and Development, Innovation and Productivity (RDIP) database developed by the National Institute of Science and Technology Policy. In the RDIP database, both nominal and real R&D investment is available for 1973–2008, by the same industry classification as the JIP database. The real R&D investment is valued at 2000 constant prices. We calculate R&D intensity for each industry-year, which is defined as the real R&D investment divided by the real value added. Because the RDIP database is not available after 2008, we focus on the period between 1980 and 2005.[29]

The fifth rows in Tables 6 and 7 show the estimation results. Other elasticities are presented in Table A8. Notable findings are twofold. First, the effect of offshoring is significantly positive for high skilled workers and insignificant for middle-high, middle-low, and low skilled workers. This pattern is the same as that in the baseline results.

Second, the effect of ICT is positive for middle-high and low skilled workers, negative for middle-low skilled workers, and insignificant for high skilled workers. This result is also the same as the baseline model. The results suggest that the effects of offshoring and ICT on labor demand are not sensitive to the inclusion of R&D intensity.

5.3 Excluding low skilled workers

One may further ask how the results change if we drop low skilled workers. Note that low skilled workers (defined as part-time workers) are classified by the occupational type while middle-low/high and high skilled workers are classified by educational level. Because part-time workers may include all of university, college/high school, and/or junior-high school graduates, strictly speaking, the categories of classification are not consistent with each other. To answer the above question, we estimate equation (4), excluding low skilled workers (defined as part-time workers) from the sample.[30]

The sixth rows in Tables 6 and 7 present the results of offshoring and ICT capital elasticities, respectively. Table A9 reports other elasticities. The effect of offshoring is significantly positive for high skilled workers. The effect of ICT is significantly positive for middle-high

[29]Because the RDIP database is not available after 2008 and the (time invariant) initial R&D intensity can be controlled for by the fixed effects, we did not include initial R&D intensity in the baseline model.

[30]The total cost and cost share of variable factors are recalculated accordingly.

skilled workers while significantly negative for middle-low skilled workers. The results are qualitatively the same as the baseline results. Note, however, that we confirmed significantly positive effects of ICT on part-time workers. By not including these workers, one will miss a part of positive effects of ICT. The result suggests the importance of including low-wage part-time workers in the sample in analyzing the effects of offshoring and ICT.

In sum, we asked whether our results are sensitive to the use of different measures of offshoring, the inclusion of an additional control variable, and the exclusion of low skilled (i.e., part-time) workers. We confirmed the positive and significant effects of offshoring on the demand for high skilled workers in most specifications. We also confirmed that the effect of ICT is significantly positive for middle-high and low skilled workers while significantly negative for middle-low skilled workers in all specifications. Moreover, the effects of offshoring on the demand for low skilled workers are insignificant in all specifications. We thus can conclude that our main messages are generally robust.[31]

6 Concluding Remarks

With the growing demand for skilled workers relative to unskilled workers, the wage inequality between skilled and unskilled workers is increasing in many countries. Determining which of these explanations account for the changes is an empirical question. It is widely believed that low skilled workers are significantly affected by the ICT and offshoring in Japan. To answer this question is very important for workers as well as policy makers in Japan.

This paper examines empirically the link between ICT, offshoring, and the skill structure of labor demand in Japan. One of the contributions of this paper is that we focus

[31]Table A1 indicates that the share of part-time workers is high in *Livestock products* and *Miscellaneous foods and related products*. Similarly, Table A2 presents that the offshoring is high in *Chemical fertilizers*. A concern may be that our results are driven by these industries. We also estimate the baseline model, dropping these three industries. We find that the results are qualitatively similar to those of the baseline model. The difference is that, if we exclude these three industries, all the elasticities of offshoring become significant (although the sings are the same as those of the baseline model).

explicitly on the demand for low-wage part-time workers. Offshoring is calculated using import-use matrices of input-output tables for manufacturing industries between 1980 and 2011. Estimating a system of variable factor demands, we found that offshoring was associated with the increasing demand for high skilled workers. We also found insignificant effects of offshoring on middle-high, middle-low, and low skilled workers. Industries with higher ICT stock shifted demand from middle-low workers to middle-high *and* low skilled workers, which is consistent with the ICT–based "job polarization." These results are generally robust even when we use different measures of offshoring or we include an additional control variable. The results together suggest that the increasing demand for low-wage part-time workers is attributable to ICT in Japan. Note that the effects of ICT and offshoring on the demand for part-time workers have not been examined in the previous studies such as Ahn et al. (2008). Our results provide a fresh insight for the discussion on the increasing demand for part-time workers.

While we found significantly positive effects of ICT on the demand for part-time workers, we could not ascertain the rapid growth of their wages. This is puzzling because, as Autor (2015, p.5) pointed out, the polarization of the labor market typically associated with the disproportional wage gains to those at the top and at the bottom of the income and skill distribution. Our analysis also could not identify the detailed mechanism of the effects of ICT on the increasing demand for part-time workers. For example, the complementarity between ICT and part-time workers could be due to the increasing demand for part-time workers who utilize ICT. It could also be attributable to the increasing demand for some routine works that cannot be substituted by ICT. Based on the fact that the share of part-time workers is increasing rapidly, more detailed analysis of the demand for part-time workers is important.[32] Moreover, although we control for some of the supply side effects by the factor-specific time trend, a more sophisticated approach is needed to control for the supply

[32] In this connection, Kiyota and Maruyama (2016) extends the analysis of this paper, distinguishing the difference between female and male workers.

side effects in a precise way. Some of these questions will be clarified in our future research.

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Appendix: Data

Sources

Data for estimating imported input are obtained from the Input-Output (IO) tables and the Japan Industrial Productivity (JIP) database. The IO tables, issued every five year by Ministry of Internal Affairs and Communications (various years), include the nominal value of imported inputs. The JIP database provided by the Research Institute of Economy, Trade and Industry is used for deflating from nominal to the real prices. We prepared imported inputs data in every five year between 1980 and 2005, and 2011.

The construction of the import-use matrices

Offshoring variables are calculated from the import-use matrices of IO tables for manufacturing industries between 1980 and 2011. Imported inputs data are provided in the Basic Transaction Matrix of IO table in which the basic sector consists of items with 6-digit column and 7-digit row codes. The transaction of intermediate inputs is reported for domestic and imported inputs separately.

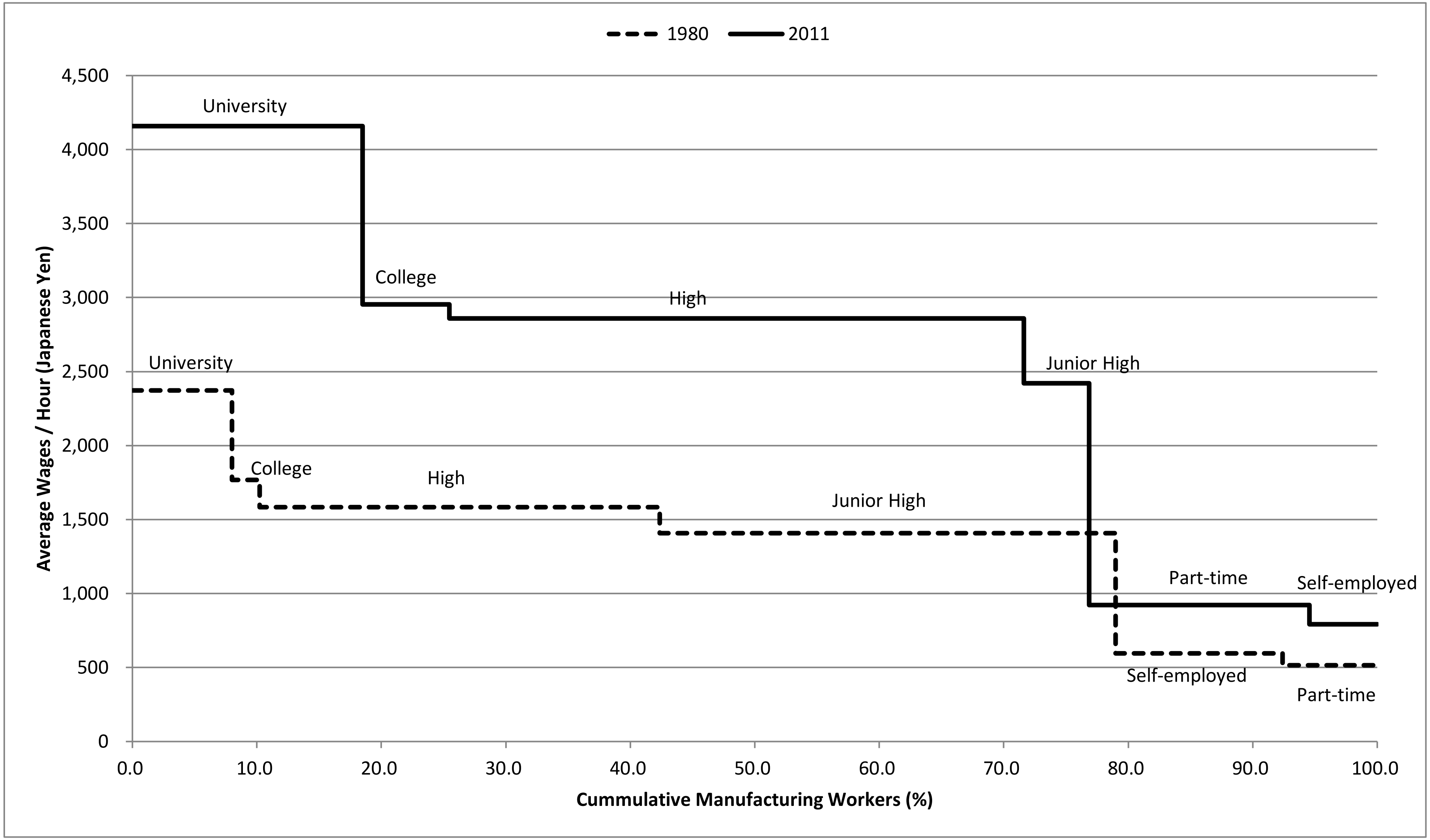
To match the IO industry classification with the JIP industry classification, we aggregate imported input data into 52 manufacturing sectors (i.e., JIP industry classification). The concordance of two classifications relies on "the industry concordance with JSIC, Japan Standard Industrial Classification, and ISIC" provided in the JIP database 2011. The benchmark year of IO basic sector classification for the concordance is 1995 with the table of 403 columns and 519 rows. We modify concordance for other years in order to reflect the revision of the basic sector classification. As for 1980 IO table, "Automobile" and "Automobile parts and accessories" are integrated in one industry. We estimate the import values of these sectors, applying the rate of change from 1985 to 1990 in the same sectors.

In the IO table, only nominal imported inputs are available. We first calculate the share of imported intermediates to total intermediate inputs and then multiply the real total intermediate inputs from the JIP database. Specifically, let θ_{ijt} be the share of nominal imported intermediate inputs of industry j from industry i in year t to nominal total intermediate inputs of industry j. Denote the real total intermediate inputs of industry j in year t as M_{jt}. To obtain the real imports of industry j from industry i, we use the following calculation:

$$O_{ijt} = \theta_{ijt} \times M_{jt},$$

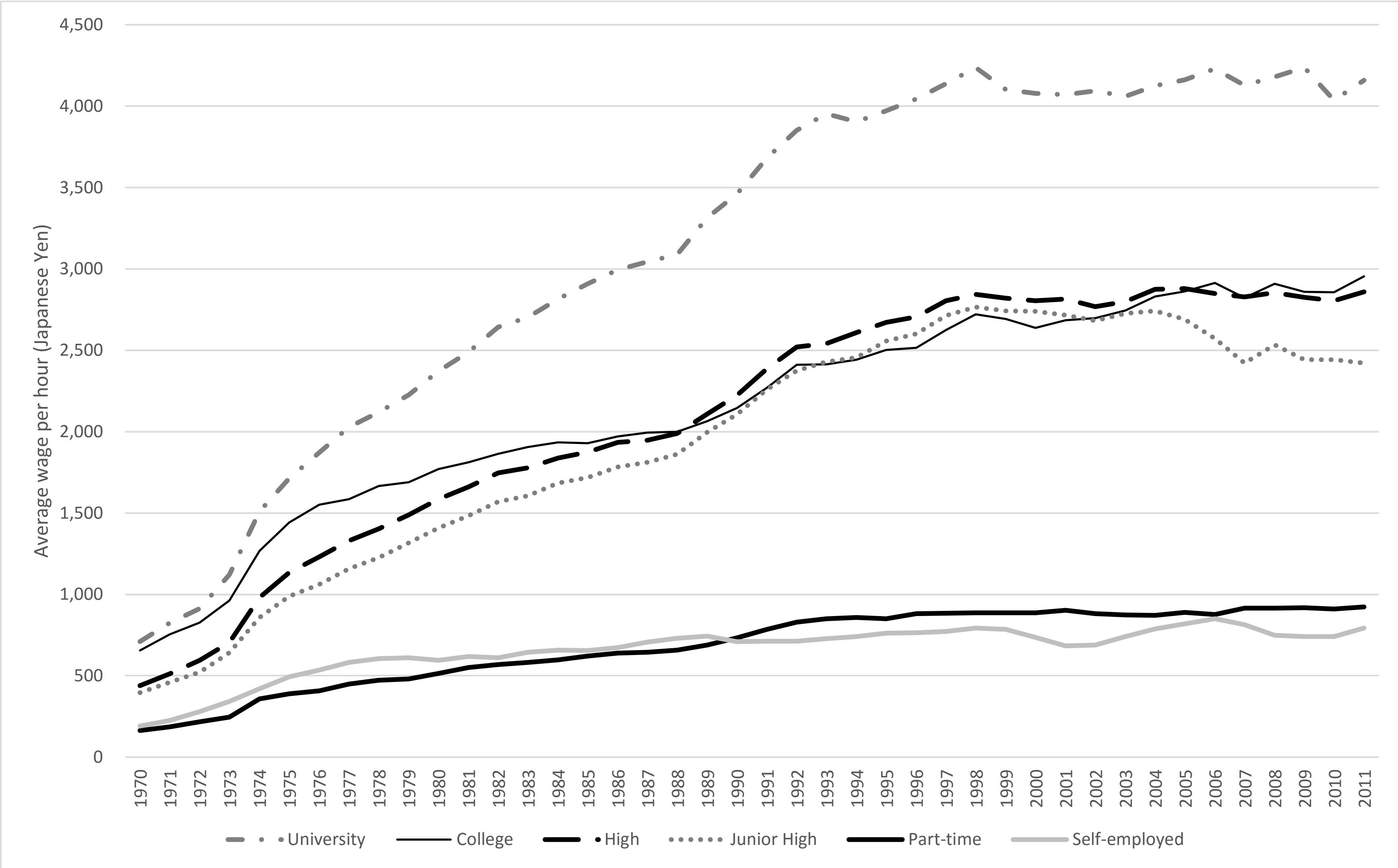
where θ_{ijt} and M_{jt} are obtained from the IO table and the JIP database, respectively.

Figure 1. Average Wages in Japanese Labor Markets, 1980 and 2011



Note: More detailed figures on the average wage and the employment share of each group are reported in Figure 2 and Figure A1, respectively.
Source: JIP database 2014.

Figure 2. Average Wage per Hour, by Education and Type of Workers: Manufacturing in Japan



Source: JIP database 2014.

Table 1. Average Cost Shares, 1980-2011

	N	Mean	Std. Dev.	Min	Max
s_H	364	0.050	0.030	0.003	0.171
s_{MH}	364	0.124	0.058	0.007	0.320
s_{ML}	364	0.046	0.037	0.001	0.187
s_L	364	0.007	0.006	0.000	0.033
s_M	364	0.773	0.098	0.509	0.988

Source: JIP database 2014.

Table 2. Annual Percentage Change, 1980-2011

	N	Mean	Std. Dev.	Min	Max
Cost shares					
s_H	52	0.001	0.001	0.000	0.003
s_{MH}	52	0.002	0.001	-0.001	0.005
s_{ML}	52	-0.002	0.001	-0.005	0.000
s_L	52	0.000	0.000	0.000	0.001
s_M	52	-0.001	0.001	-0.004	0.003
Input quantities					
L_H	52	0.013	0.021	-0.038	0.076
L_{MH}	52	0.000	0.020	-0.058	0.054
L_{ML}	52	-0.077	0.020	-0.144	-0.028
L_L	52	0.016	0.021	-0.032	0.076
M	52	0.004	0.025	-0.040	0.077
Flexible factor prices					
w_H	52	0.018	0.007	-0.013	0.038
w_{MH}	52	0.018	0.007	-0.013	0.036
w_{ML}	52	0.016	0.008	-0.018	0.035
w_L	52	0.018	0.008	-0.008	0.044
p_M	52	-0.001	0.012	-0.041	0.028
Fixed input and output quantities					
ICT capital stock	52	0.088	0.025	0.011	0.143
Non-ICT capital stock	52	0.022	0.019	-0.022	0.094
Output	52	0.021	0.065	-0.093	0.282

Source: JIP database 2014.

Table 3. Offshoring and ICT, 1980-2011

	Offshoring			ICT capital share
	Narrow	Differential	Broad	
1980	0.021	0.053	0.074	0.024
1985	0.024	0.055	0.079	0.050
1990	0.030	0.061	0.091	0.071
1995	0.042	0.061	0.103	0.082
2000	0.047	0.078	0.124	0.104
2005	0.057	0.097	0.154	0.127
2011	0.053	0.110	0.163	0.150

Note: "Differential" is defined as the difference between the broad and narrow definition. ICT capital share is the share of ICT capital stock to total capital stock. Source: JIP database 2014 and Ministry of Internal Affairs and Communications (various years).

Table 4. Preliminary Analysis: Full-time versus Part-time

	Fixed effects SUR		Elasticities		
	L_F	L_L	L_F	L_L	M
w_F	0.069***	-0.001	*-0.465****		
	(0.008)	(0.002)	*(0.035)*		
w_L	-0.001	0.002	0.103	*-0.704***	
	(0.002)	(0.002)	(0.235)	*(0.293)*	
p_M			0.461***	0.601***	*-0.137****
			(0.036)	(0.152)	*(0.011)*
Offshoring	0.058	0.005	0.262	0.702	-0.081
	(0.046)	(0.005)	(0.209)	(0.712)	(0.062)
ICT capital	-0.001	0.002***	-0.003	0.265***	-0.002
	(0.004)	(0.000)	(0.019)	(0.064)	(0.006)
Non-ICT capital	-0.011	-0.001	-0.052	-0.187	0.017*
	(0.007)	(0.001)	(0.033)	(0.114)	(0.010)
Output	-0.010***	-0.002***	-0.048***	-0.212***	0.016***
	(0.004)	(0.000)	(0.018)	(0.062)	(0.005)
N	364	364			
R-squared	0.993	0.959			
Year FE	Yes	Yes			
Industry FE	Yes	Yes			
Factor-specific time trend	Yes	Yes			

Notes: Figures in parentheses are standard errors. ***, **, and * indicate statistically significance at 1%, 5%, and 10% levels, respectively. The null hypothesis that the fixed effect equals zero is rejected at 1% level in all equations. Shaded coefficients are constrained by symmetry constraints. Offshoring is measured by narrow measure. The own price elasticities are reported in italic.

Source: JIP database 2014 and Ministry of Internal Affairs and Communications (various years).

Table 5. Factor Demand and Other Elasticities, 1980-2011: Baseline Results

	L_H	L_{MH}	L_{ML}	L_L	M
w_H	*-0.296*				
	(0.218)				
w_{MH}	-0.102	*-0.596****			
	(0.097)	*(0.167)*			
w_{ML}	0.325	0.688*	*-1.726****		
	(0.247)	(0.380)	*(0.484)*		
w_L	0.851**	-1.402**	0.454	*-0.501***	
	(0.406)	(0.547)	(0.444)	*(0.254)*	
p_M	0.127*	0.527***	0.641***	0.598***	*-0.137****
	(0.068)	(0.053)	(0.108)	(0.131)	*(0.011)*
Offshoring	0.880**	0.257	-0.294	0.836	-0.089
	(0.374)	(0.298)	(0.603)	(0.616)	(0.062)
ICT capital	-0.038	0.108***	-0.245***	0.229***	-0.003
	(0.034)	(0.027)	(0.056)	(0.057)	(0.006)
Non-ICT capital	-0.038	-0.230***	0.401***	-0.166*	0.017*
	(0.059)	(0.047)	(0.096)	(0.098)	(0.010)
Output	0.071**	-0.076***	-0.090*	-0.200***	0.015***
	(0.032)	(0.026)	(0.052)	(0.053)	(0.005)

Notes: Figures in parentheses are standard errors. ***, **, and * indicate statistically significance at 1%, 5%, and 10% levels, respectively. Offshoring is measured by narrow measure. The own price elasticities are reported in italic.

Sources: JIP database 2014 and Ministry of Internal Affairs and Communications (various years).

Table 6. Robustness Check: Offshoring Elasticity

	L_H	L_{MH}	L_{ML}	L_L	M
Baseline	0.880**	0.257	-0.294	0.836	-0.089
	(0.374)	(0.298)	(0.603)	(0.616)	(0.062)
Broad measure	0.519**	-0.518**	0.371	-0.065	0.028
	(0.255)	(0.203)	(0.412)	(0.422)	(0.043)
Relative to all	1.283**	0.318	-0.465	1.480	-0.120
intermediate inputs	(0.596)	(0.475)	(0.963)	(0.982)	(0.100)
Relative to gross	0.633	-0.453	-1.220	0.038	0.104
output	(0.909)	(0.721)	(1.458)	(1.492)	(0.151)
Adding R&D as a	0.628*	0.002	-0.121	0.572	-0.039
control variable	(0.343)	(0.302)	(0.587)	(0.668)	(0.064)
Excluding low skilled	0.892**	0.262	-0.290		-0.083
workers	(0.374)	(0.304)	(0.603)		(0.061)

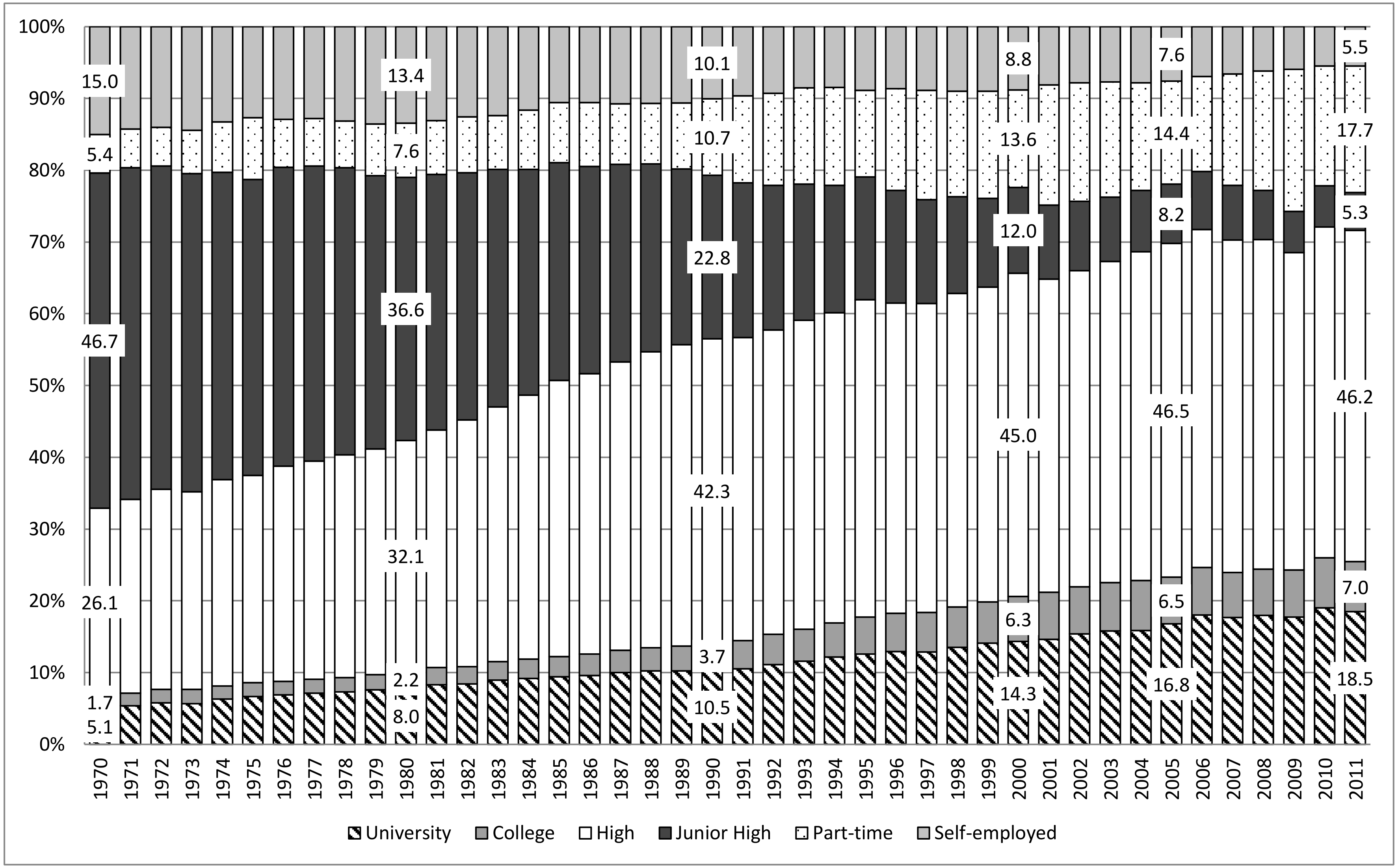
For notes and sources, see Table 5.

Table 7. Robustness Check: ICT Capital Stock Elasticity

	L_H	L_{MH}	L_{ML}	L_L	M
Baseline	-0.038	0.108***	-0.245***	0.229***	-0.003
	(0.034)	(0.027)	(0.056)	(0.057)	(0.006)
Broad measure	-0.035	0.112***	-0.250***	0.238***	-0.003
	(0.034)	(0.027)	(0.056)	(0.057)	(0.006)
Relative to all	-0.036	0.108***	-0.245***	0.229***	-0.003
intermediate inputs	(0.034)	(0.027)	(0.056)	(0.057)	(0.006)
Relative to gross	-0.033	0.109***	-0.244***	0.234***	-0.003
output	(0.034)	(0.027)	(0.056)	(0.057)	(0.006)
Adding R&D as a	-0.033	0.105***	-0.304***	0.224***	0.001
control variable	(0.032)	(0.028)	(0.055)	(0.062)	(0.006)
Excluding low skilled	-0.034	0.110***	-0.243***		-0.001
workers	(0.034)	(0.028)	(0.056)		(0.005)

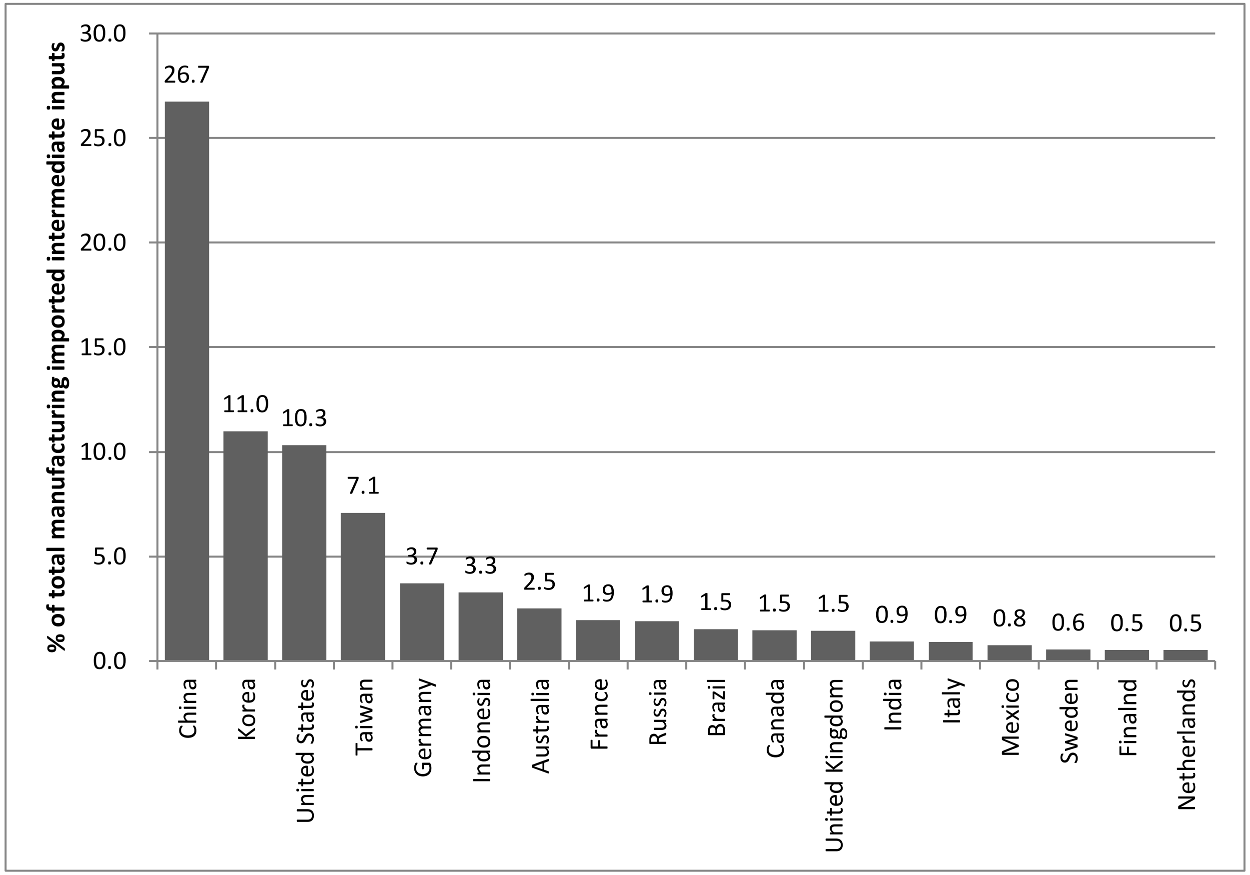
For notes and sources, see Table 5.

Figure A1. Share of Workers, by Education and Type of Workers: Manufacturing in Japan



Source: JIP database 2014.

Figure A2. Share of Manufacturing Imported Intermediate Inputs in Japan in 2011, by Country



Notes: The rest of the world (20.6%) and countries whose share are less than 0.5 percent are not reported.

Source: World Input-Output Database, November 2013 release.

Table A1. Share of Part-time Workers, 1980-2011, by Industry

Industry	1980	1985	1990	1995	2000	2005	2011
Livestock products	0.126	0.132	0.172	0.212	0.231	0.238	0.419
Miscellaneous foods and related products	0.179	0.193	0.249	0.287	0.307	0.321	0.404
Seafood products	0.140	0.148	0.179	0.224	0.271	0.279	0.318
Flour and grain mill products	0.075	0.081	0.125	0.166	0.209	0.203	0.270
Textile products	0.093	0.098	0.121	0.153	0.196	0.208	0.230
Miscellaneous manufacturing industries	0.118	0.125	0.147	0.162	0.198	0.200	0.228
Precision machinery & equipment	0.102	0.105	0.128	0.143	0.136	0.138	0.228
Petroleum products	0.049	0.048	0.048	0.068	0.110	0.104	0.225
Leather and leather products	0.109	0.119	0.142	0.177	0.217	0.225	0.221
Beverages	0.073	0.074	0.097	0.124	0.173	0.187	0.216
Electrical generating, transmission, distribution and industrial apparatus	0.093	0.103	0.128	0.130	0.108	0.085	0.213
Organic chemicals	0.148	0.142	0.163	0.156	0.162	0.165	0.212
Electronic data processing machines, digital and analog computer equipment and accessories	0.095	0.100	0.120	0.109	0.119	0.107	0.211
Pottery	0.088	0.090	0.118	0.133	0.162	0.180	0.206
Prepared animal foods and organic fertilizers	0.074	0.079	0.112	0.135	0.162	0.166	0.206
Miscellaneous chemical products	0.093	0.096	0.118	0.122	0.150	0.151	0.205
Rubber products	0.091	0.098	0.130	0.134	0.143	0.146	0.203
Paper products	0.130	0.135	0.157	0.166	0.172	0.182	0.196
Plastic products	0.126	0.133	0.153	0.162	0.177	0.190	0.196
Printing, plate making for printing and bookbinding	0.090	0.097	0.111	0.126	0.135	0.145	0.194
Pulp, paper, and coated and glazed paper	0.052	0.052	0.068	0.079	0.123	0.125	0.194
Miscellaneous fabricated metal products	0.086	0.092	0.118	0.125	0.124	0.148	0.192
Furniture and fixtures	0.086	0.088	0.101	0.110	0.128	0.148	0.187
Pharmaceutical products	0.063	0.065	0.089	0.106	0.104	0.111	0.187
Non-ferrous metal products	0.080	0.083	0.107	0.115	0.124	0.125	0.186
Basic inorganic chemicals	0.096	0.092	0.112	0.131	0.163	0.151	0.180
General industry machinery	0.065	0.067	0.094	0.095	0.096	0.094	0.179
Electronic equipment and electric measuring instruments	0.096	0.104	0.137	0.127	0.105	0.104	0.177
Tobacco	0.007	0.007	0.025	0.061	0.118	0.190	0.174
Fabricated constructional and architectural metal products	0.094	0.096	0.118	0.127	0.150	0.158	0.167
Special industry machinery	0.049	0.051	0.069	0.070	0.067	0.113	0.167
Lumber and wood products	0.069	0.068	0.084	0.107	0.131	0.153	0.160
Other transportation equipment	0.062	0.062	0.073	0.078	0.094	0.100	0.156
Miscellaneous ceramic, stone and clay products	0.070	0.068	0.087	0.105	0.120	0.132	0.153
Office and service industry machines	0.062	0.068	0.088	0.100	0.142	0.146	0.151
Cement and its products	0.046	0.044	0.052	0.058	0.077	0.102	0.151
Miscellaneous iron and steel	0.072	0.073	0.104	0.123	0.135	0.134	0.148
Chemical fibers	0.068	0.070	0.123	0.155	0.148	0.154	0.137
Electronic parts	0.096	0.102	0.120	0.123	0.186	0.118	0.136
Smelting and refining of non-ferrous metals	0.077	0.077	0.082	0.075	0.092	0.112	0.136
Glass and its products	0.088	0.089	0.115	0.105	0.124	0.131	0.135
Semiconductor devices and integrated circuits	0.078	0.081	0.095	0.098	0.068	0.180	0.127
Miscellaneous electrical machinery equipment	0.113	0.119	0.146	0.146	0.160	0.180	0.125
Household electric appliances	0.087	0.092	0.111	0.125	0.151	0.152	0.115
Basic organic chemicals	0.024	0.085	0.099	0.131	0.130	0.100	0.112
Coal products	0.062	0.061	0.070	0.095	0.102	0.110	0.096
Communication equipment	0.105	0.108	0.117	0.114	0.122	0.080	0.085
Pig iron and crude steel	0.033	0.031	0.054	0.051	0.044	0.064	0.079
Miscellaneous machinery	0.077	0.082	0.103	0.099	0.100	0.115	0.071
Chemical fertilizers	0.055	0.054	0.072	0.090	0.086	0.080	0.070
Motor vehicle parts and accessories	0.051	0.051	0.074	0.077	0.094	0.092	0.070
Motor vehicles	0.037	0.035	0.055	0.060	0.054	0.087	0.060

Offshoring is based on narrow definition. Sorted by the descending order in 2011.

Source: JIP database 2014.

Table A2. Offshoring, 1980-2011, by Industry

Industry	1980	1985	1990	1995	2000	2005	2011
Chemical fertilizers	0.013	0.007	0.033	0.116	0.176	0.312	0.228
Basic inorganic chemicals	0.070	0.084	0.097	0.091	0.096	0.163	0.176
Textile products	0.048	0.067	0.086	0.095	0.105	0.139	0.175
Organic chemicals	0.051	0.077	0.085	0.100	0.113	0.131	0.152
Leather and leather products	0.044	0.045	0.079	0.106	0.145	0.164	0.138
Lumber and wood products	0.013	0.028	0.044	0.068	0.095	0.106	0.131
Smelting and refining of non-ferrous metals	0.086	0.086	0.147	0.160	0.081	0.107	0.123
Seafood products	0.003	0.053	0.089	0.151	0.127	0.139	0.112
Livestock products	0.027	0.069	0.061	0.087	0.094	0.106	0.107
Other transportation equipment	0.033	0.090	0.081	0.064	0.114	0.102	0.100
General industry machinery	0.010	0.013	0.016	0.020	0.052	0.067	0.088
Miscellaneous foods and related products	0.115	0.052	0.050	0.059	0.052	0.077	0.086
Semiconductor devices and integrated circuits	0.009	0.029	0.060	0.062	0.056	0.124	0.085
Miscellaneous chemical products	0.016	0.024	0.040	0.029	0.033	0.044	0.079
Plastic products	0.003	0.005	0.015	0.020	0.038	0.060	0.075
Electronic data processing machines, digital and analog computer equipment and accessories	0.060	0.094	0.070	0.114	0.053	0.047	0.070
Pulp, paper, and coated and glazed paper	0.077	0.080	0.116	0.122	0.102	0.081	0.069
Special industry machinery	0.011	0.007	0.022	0.029	0.063	0.069	0.066
Miscellaneous ceramic, stone and clay products	0.020	0.019	0.003	0.030	0.062	0.074	0.060
Electronic parts	0.011	0.009	0.005	0.028	0.072	0.121	0.058
Pharmaceutical products	0.119	0.019	0.021	0.099	0.022	0.028	0.053
Electrical generating, transmission, distribution and industrial apparatus	0.009	0.012	0.015	0.024	0.048	0.052	0.050
Miscellaneous manufacturing industries	0.036	0.018	0.022	0.023	0.017	0.056	0.044
Pig iron and crude steel	0.031	0.051	0.065	0.095	0.053	0.077	0.043
Beverages	0.003	0.006	0.012	0.008	0.012	0.021	0.040
Precision machinery & equipment	0.028	0.029	0.045	0.102	0.154	0.034	0.038
Non-ferrous metal products	0.000	0.002	0.007	0.005	0.013	0.030	0.036
Electronic equipment and electric measuring instruments	0.024	0.028	0.020	0.011	0.031	0.027	0.036
Furniture and fixtures	0.007	0.008	0.027	0.026	0.044	0.058	0.035
Miscellaneous electrical machinery equipment	0.036	0.016	0.020	0.048	0.060	0.077	0.034
Household electric appliances	0.004	0.004	0.011	0.028	0.051	0.033	0.029
Motor vehicle parts and accessories	0.000	0.001	0.002	0.004	0.007	0.019	0.026
Glass and its products	0.007	0.028	0.007	0.002	0.003	0.005	0.023
Miscellaneous fabricated metal products	0.003	0.002	0.006	0.009	0.009	0.020	0.020
Miscellaneous machinery	0.012	0.006	0.005	0.009	0.029	0.022	0.016
Miscellaneous iron and steel	0.003	0.012	0.021	0.018	0.013	0.013	0.015
Rubber products	0.006	0.007	0.009	0.014	0.013	0.017	0.014
Office and service industry machines	0.005	0.005	0.010	0.020	0.033	0.025	0.012
Petroleum products	0.010	0.024	0.016	0.031	0.003	0.007	0.007
Cement and its products	0.000	0.003	0.009	0.003	0.007	0.007	0.005
Communication equipment	0.000	0.000	0.000	0.002	0.003	0.002	0.004
Fabricated constructional and architectural metal products	0.000	0.000	0.000	0.000	0.000	0.003	0.003
Coal products	0.002	0.000	0.000	0.000	0.000	0.000	0.003
Printing, plate making for printing and bookbinding	0.000	0.001	0.002	0.002	0.001	0.002	0.003
Flour and grain mill products	0.000	0.000	0.000	0.000	0.000	0.001	0.002
Basic organic chemicals	0.000	0.002	0.002	0.001	0.001	0.001	0.002
Pottery	0.005	0.001	0.005	0.001	0.002	0.003	0.002
Prepared animal foods and organic fertilizers	0.000	0.008	0.018	0.035	0.056	0.066	0.001
Motor vehicles	0.000	0.000	0.000	0.000	0.000	0.000	0.001
Paper products	0.000	0.000	0.000	0.000	0.000	0.000	0.000
Tobacco	0.002	0.023	0.007	0.002	0.010	0.000	0.000
Chemical fibers	0.000	0.000	0.000	0.000	0.000	0.000	0.000

Offshoring is based on narrow definition. Sorted by the descending order in 2011.

Source: JIP database 2014.

Table A3. ICT Capital Share, 1980-2011, by Industry

Industry	1980	1985	1990	1995	2000	2005	2011
Electronic equipment and electric measuring instruments	0.054	0.172	0.221	0.209	0.288	0.366	0.427
Electronic data processing machines, digital and analog computer equipment and accessories	0.042	0.153	0.203	0.217	0.314	0.358	0.383
Electronic parts	0.042	0.102	0.174	0.190	0.234	0.298	0.320
Communication equipment	0.048	0.117	0.126	0.132	0.206	0.253	0.297
Miscellaneous electrical machinery equipment	0.046	0.074	0.146	0.161	0.193	0.252	0.285
Household electric appliances	0.051	0.093	0.136	0.165	0.200	0.237	0.269
Electrical generating, transmission, distribution and industrial apparatus	0.045	0.130	0.187	0.182	0.213	0.232	0.248
Precision machinery & equipment	0.087	0.138	0.166	0.177	0.189	0.206	0.222
Office and service industry machines	0.025	0.133	0.150	0.145	0.174	0.198	0.216
Miscellaneous manufacturing industries	0.011	0.032	0.068	0.102	0.128	0.166	0.214
Printing, plate making for printing and bookbinding	0.013	0.033	0.060	0.083	0.107	0.161	0.206
Special industry machinery	0.025	0.072	0.082	0.095	0.125	0.146	0.199
Basic inorganic chemicals	0.025	0.043	0.068	0.098	0.130	0.169	0.196
Other transportation equipment	0.022	0.032	0.080	0.123	0.140	0.147	0.193
Miscellaneous machinery	0.028	0.112	0.128	0.114	0.129	0.146	0.179
Smelting and refining of non-ferrous metals	0.019	0.037	0.089	0.116	0.142	0.145	0.176
Chemical fertilizers	0.025	0.041	0.057	0.074	0.103	0.134	0.163
Leather and leather products	0.011	0.011	0.036	0.067	0.104	0.125	0.161
Flour and grain mill products	0.010	0.028	0.053	0.063	0.077	0.133	0.160
General industry machinery	0.024	0.070	0.105	0.120	0.139	0.137	0.153
Pottery	0.014	0.023	0.046	0.074	0.107	0.114	0.138
Miscellaneous fabricated metal products	0.015	0.022	0.059	0.069	0.084	0.107	0.134
Fabricated constructional and architectural metal products	0.014	0.030	0.049	0.066	0.089	0.108	0.132
Pharmaceutical products	0.040	0.071	0.084	0.079	0.095	0.119	0.129
Tobacco	0.011	0.014	0.022	0.044	0.054	0.080	0.129
Furniture and fixtures	0.007	0.017	0.047	0.064	0.092	0.102	0.128
Chemical fibers	0.026	0.033	0.038	0.052	0.071	0.098	0.124
Seafood products	0.010	0.018	0.042	0.052	0.061	0.093	0.123
Livestock products	0.011	0.019	0.038	0.048	0.059	0.087	0.119
Rubber products	0.021	0.025	0.042	0.054	0.069	0.096	0.119
Basic organic chemicals	0.028	0.038	0.047	0.055	0.083	0.117	0.118
Miscellaneous foods and related products	0.011	0.021	0.044	0.051	0.060	0.087	0.114
Miscellaneous chemical products	0.028	0.046	0.053	0.061	0.079	0.107	0.111
Textile products	0.007	0.012	0.032	0.049	0.064	0.085	0.109
Plastic products	0.011	0.012	0.019	0.031	0.045	0.075	0.103
Miscellaneous iron and steel	0.040	0.054	0.052	0.055	0.070	0.079	0.103
Organic chemicals	0.026	0.039	0.048	0.053	0.070	0.093	0.101
Petroleum products	0.011	0.024	0.044	0.058	0.062	0.080	0.094
Lumber and wood products	0.005	0.009	0.022	0.033	0.050	0.062	0.091
Miscellaneous ceramic, stone and clay products	0.013	0.017	0.025	0.038	0.063	0.076	0.091
Pulp, paper, and coated and glazed paper	0.014	0.027	0.042	0.052	0.077	0.082	0.084
Glass and its products	0.016	0.027	0.036	0.046	0.064	0.071	0.083
Beverages	0.010	0.015	0.027	0.032	0.040	0.061	0.082
Motor vehicles	0.024	0.028	0.031	0.035	0.053	0.071	0.081
Semiconductor devices and integrated circuits	0.048	0.180	0.161	0.128	0.101	0.085	0.076
Motor vehicle parts and accessories	0.024	0.031	0.037	0.040	0.049	0.060	0.073
Prepared animal foods and organic fertilizers	0.012	0.019	0.025	0.023	0.030	0.050	0.070
Cement and its products	0.013	0.017	0.033	0.050	0.071	0.071	0.067
Coal products	0.014	0.017	0.023	0.023	0.027	0.047	0.063
Pig iron and crude steel	0.023	0.024	0.024	0.029	0.039	0.044	0.060
Paper products	0.012	0.016	0.024	0.041	0.053	0.053	0.058
Non-ferrous metal products	0.020	0.025	0.033	0.033	0.043	0.048	0.052

ICT capital share is the share of ICT capital stock to total capital stock. Sorted by the descending order in 2011.
Source: JIP database 2014.

Table A4. Regression Results, 1980-2011

Fixed effects SUR	L_H	L_{MH}	L_{ML}	L_L
w_H	0.033***	-0.019	0.013	0.006**
	(0.011)	(0.012)	(0.011)	(0.003)
w_{MH}	-0.019	0.035*	0.026	-0.011***
	(0.012)	(0.021)	(0.017)	(0.004)
w_{ML}	0.013	0.026	-0.035	0.003
	(0.011)	(0.017)	(0.022)	(0.003)
w_L	0.006**	-0.011***	0.003	0.004*
	(0.003)	(0.004)	(0.003)	(0.002)
Offshoring	0.044**	0.032	-0.014	0.006
	(0.019)	(0.037)	(0.028)	(0.005)
ICT capital	-0.002	0.013***	-0.011***	0.002***
	(0.002)	(0.003)	(0.003)	(0.000)
Non-ICT capital	-0.002	-0.029***	0.018***	-0.001*
	(0.003)	(0.006)	(0.004)	(0.001)
Output	0.004**	-0.009***	-0.004*	-0.001***
	(0.002)	(0.003)	(0.002)	(0.000)
N	364	364	364	364
R-squared	0.980	0.985	0.956	0.959
Year FE	Yes	Yes	Yes	Yes
Industry FE	Yes	Yes	Yes	Yes
Factor-specific time trend	Yes	Yes	Yes	Yes

For notes and sources, see Table 4.

Table A5. Robustness Check 1: Broad Offshoring

	L_H	L_{MH}	L_{ML}	L_L	M
w_H	*-0.249*				
	(0.213)				
w_{MH}	-0.146	*-0.483***			
	(0.095)	*(0.164)*			
w_{ML}	0.364	0.561	*-1.651****		
	(0.245)	(0.376)	*(0.483)*		
w_L	0.741*	-1.210**	0.373	*-0.503***	
	(0.403)	(0.543)	(0.440)	*(0.254)*	
p_M	0.168**	0.493***	0.667***	0.599***	*-0.135****
	(0.069)	(0.054)	(0.111)	(0.135)	*(0.011)*
Offshoring	0.519**	-0.518**	0.371	-0.065	0.028
	(0.255)	(0.203)	(0.412)	(0.422)	(0.043)
ICT capital	-0.035	0.112***	-0.250***	0.238***	-0.003
	(0.034)	(0.027)	(0.056)	(0.057)	(0.006)
Non-ICT capital	-0.024	-0.251***	0.416***	-0.174*	0.019*
	(0.060)	(0.048)	(0.097)	(0.099)	(0.010)
Output	0.054	-0.066**	-0.097*	-0.204***	0.015***
	(0.033)	(0.026)	(0.053)	(0.054)	(0.006)

For notes and sources, see Table 5.

Table A6. Robustness Check 2: Relative to All Intermediate Inputs

	L_H	L_{MH}	L_{ML}	L_L	M
w_H	*-0.310*				
	(0.217)				
w_{MH}	-0.101	*-0.597****			
	(0.097)	*(0.167)*			
w_{ML}	0.333	0.683*	*-1.731****		
	(0.247)	(0.381)	*(0.485)*		
w_L	0.844**	-1.413***	0.475	*-0.508***	
	(0.406)	(0.547)	(0.445)	*(0.255)*	
p_M	0.130*	0.529***	0.639***	0.602***	*-0.137****
	(0.068)	(0.053)	(0.108)	(0.132)	*(0.011)*
Offshoring	1.283**	0.318	-0.465	1.480	-0.120
	(0.596)	(0.475)	(0.963)	(0.982)	(0.100)
ICT capital	-0.036	0.108***	-0.245***	0.229***	-0.003
	(0.034)	(0.027)	(0.056)	(0.057)	(0.006)
Non-ICT capital	-0.041	-0.231***	0.401***	-0.167*	0.017*
	(0.059)	(0.047)	(0.096)	(0.098)	(0.010)
Output	0.066**	-0.078***	-0.089*	-0.204***	0.015***
	(0.032)	(0.026)	(0.052)	(0.053)	(0.005)

For notes and sources, see Table 5.

Table A7. Robustness Check 3: Relative to Gross Output

	L_H	L_{MH}	L_{ML}	L_L	M
w_H	*-0.313*				
	(0.217)				
w_{MH}	-0.090	*-0.618****			
	(0.096)	*(0.166)*			
w_{ML}	0.307	0.704*	*-1.724****		
	(0.247)	(0.380)	*(0.483)*		
w_L	0.839**	-1.372**	0.430	*-0.498**	
	(0.405)	(0.546)	(0.443)	*(0.254)*	
p_M	0.131*	0.528***	0.644***	0.601***	*-0.137****
	(0.068)	(0.053)	(0.108)	(0.132)	*(0.011)*
Offshoring	0.633	-0.453	-1.220	0.038	0.104
	(0.909)	(0.721)	(1.458)	(1.492)	(0.151)
ICT capital	-0.033	0.109***	-0.244***	0.234***	-0.003
	(0.034)	(0.027)	(0.056)	(0.057)	(0.006)
Non-ICT capital	-0.045	-0.230***	0.404***	-0.170*	0.018*
	(0.060)	(0.047)	(0.096)	(0.099)	(0.010)
Output	0.071**	-0.082***	-0.099*	-0.205***	0.016***
	(0.033)	(0.027)	(0.054)	(0.055)	(0.006)

For notes and sources, see Table 5.

Table A8. Robustness Check 4: R&D Intensity

	L_H	L_{MH}	L_{ML}	L_L	M
w_H	*-0.508***				
	(0.229)				
w_{MH}	-0.092	*-0.674****			
	(0.104)	*(0.198)*			
w_{ML}	0.337	0.363	*-1.107**		
	(0.281)	(0.483)	*(0.591)*		
w_L	0.708	-0.738	-0.199	*-0.654***	
	(0.456)	(0.646)	(0.580)	*(0.298)*	
p_M	0.321***	0.675***	0.439***	0.884***	*-0.164****
	(0.076)	(0.065)	(0.129)	(0.175)	*(0.014)*
Offshoring	0.628*	0.002	-0.121	0.572	-0.039
	(0.343)	(0.302)	(0.587)	(0.668)	(0.064)
ICT capital	-0.033	0.105***	-0.304***	0.224***	0.001
	(0.032)	(0.028)	(0.055)	(0.062)	(0.006)
Non-ICT capital	0.043	-0.146***	0.304***	-0.060	0.003
	(0.057)	(0.051)	(0.098)	(0.112)	(0.011)
Output	0.032	-0.129***	-0.092*	-0.267***	0.027***
	(0.032)	(0.028)	(0.056)	(0.063)	(0.006)
R&D intensity	0.001**	-0.001*	-0.000	-0.001	0.000
	(0.000)	(0.000)	(0.001)	(0.001)	(0.000)

For notes and sources, see Table 5.

Table A9. Robustness Check 5: Excluding Low Skilled Workers

	L_H	L_{MH}	L_{ML}	L_L	M
w_H	*-0.210*				
	(0.213)				
w_{MH}	-0.113	*-0.657****			
	(0.097)	*(0.168)*			
w_{ML}	0.355	0.719*	*-1.741****		
	(0.247)	(0.385)	*(0.486)*		
w_L					
p_M	0.166**	0.505***	0.667***		*-0.132****
	(0.065)	(0.052)	(0.105)		*(0.011)*
Offshoring	0.892**	0.262	-0.290		-0.083
	(0.374)	(0.304)	(0.603)		(0.061)
ICT capital	-0.034	0.110***	-0.243***		-0.001
	(0.034)	(0.028)	(0.056)		(0.005)
Non-ICT capital	-0.046	-0.228***	0.396***		0.016*
	(0.059)	(0.048)	(0.096)		(0.010)
Output	0.069**	-0.079***	-0.090*		0.014***
	(0.032)	(0.026)	(0.052)		(0.005)

For notes and sources, see Table 5.