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Import Competition and Manufacturing Employment in Japan

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Abstract

This paper investigates the effects of increased import competition on Japanese manufacturing employment at the four-digit industry level from the mid 1990s to the early 2000s. The estimation results of a labor demand equation indicate that decreases in import prices are closely related to the decline in employment in labor-intensive industries exposed to severe import competition. This suggests that import competition is a key factor in explaining the harsh employment situation observed in the Japanese manufacturing sector since the mid 1990s.

Keywords: import competition, import prices, labor demand equation, import-competing industries
JEL Classification Number: E24, F16, J23

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1. INTRODUCTION

Japan's employment has experienced sluggish growth since the 1990s, and severe employment adjustments have been enforced, especially in the manufacturing sector. According to the *Monthly Labor Survey* of the Ministry of Health, Labor, and Welfare, while regular employment in nonmanufacturing has increased on average by 0.8 percent per annum since 1995, employment in manufacturing has continued to fall by 2.0 percent per annum, as shown in Figure 1(1). Although domestic economic conditions, technological progress, and the trend toward a service economy, among others, may be useful in explaining normal employment decline in the manufacturing sector, the intensification of international competition, particularly import competition accompanied by the greater prominence of other Asian countries, is also suggested.

According to Figure 1(2), the value of imports to Japan has risen moderately during the past 20 years, while there has been a rapid acceleration in import values from other Asian countries. Asian countries, in general, have a comparative advantage in the production and export of labor-intensive products based on their cheap and abundant labor forces. Following in the wake of economic globalization, Japan has imported a large volume of cheap labor-intensive products from these countries since the 1990s. In this respect, the share of imports from Asian countries in total Japanese imports has risen to 44.4 percent in 2005, compared with 28.7 percent in 1990.[1] As a result, price competition between imported products and domestic products has intensified ("import competition" hereafter). It is then expected that domestic industries specializing in the production of import-competing products have been obliged to carry out severe employment adjustments.

Accordingly, this paper analyzes the effects of import competition on the labor market in Japan by focusing on the relationship between import prices and manufacturing employment. Specifically, we estimate the labor demand equation using longitudinal data on Japanese manufacturing industries, and explore whether the fall in import prices has substantially affected the decline in domestic manufacturing employment.

We now turn to an overview of the literature that has studied the effects of import competition on the labor market. For the most part, many of these studies have been undertaken in the US with the move to an open economy in the 1970s. Grossman (1985), for instance, argues that employment in the US steel industry declined because of intensive import competition from the late 1970s to the early 1980s. Branson and Love (1988), Revenga (1992), and Campa and Goldberg (2001) also conclude that changes in the real foreign exchange rate have had a significant effect on changes in US

[1] The value of imports from mainland China has grown on average by 14.5 percent annually since 1995. As a result, in 2002 China overtook the US as the largest point of origin for Japanese imports.

manufacturing employment and wages.[2] Moreover, Bernard *et al.* (2002) conclude that both employment and output growth are slower for plants in industries that face higher levels of low-wage import competition.

Compared with US studies, most of the Japanese literature focuses on the period up until the early 1990s. This typically entails the hypothesis that the substantial yen appreciation in the foreign exchange market from the mid to late 1980s or during the early 1990s induced import competition, resulting in a decrease in Japanese manufacturing employment. Dekle (1998), for example, undertakes an empirical study using industry data at the two-digit level during the period 1975–1994, and concludes that the employment decline relates to price decreases in Japan's trading partners, and that this relationship is found equally across different industries. An important study by Tomiura (2003) investigates the relationship between import prices and domestic employment using longitudinal data on Japanese manufacturing industries at the four-digit level during the period 1988–1995. The industrial classification used in that study, i.e., the four-digit industrial classification, is more disaggregated than industry data at the two-digit level, thereby making it possible to control for the characteristics or heterogeneities of disaggregated industries. Based on the empirical results, Tomiura (2003) reported that a positive relationship between import prices and domestic employment is observed during the sample period. In addition, the relationship becomes clearer during the period 1993–1995, when both the decline in asset prices and the yen appreciation was evident. The study also found significant effects of import competition, especially in industries with high import ratios. This particular finding lies in contrast to Dekle (1998) where there appeared to be no difference in the effects of import competition by industry.[3]

When compared with the extant literature, this paper has two notable features as follows. First, the analysis focuses on the period after the mid 1990s. As stated at the beginning of the paper, the value of imports to Japan, especially from Asian countries,

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[2] Outside of these studies, Hakura (1997), for example, investigates the effects of change in both export and import prices on US manufacturing employments and wages by considering the effects of total trade on the labor market. Burgess and Knetter (1998) enlarge the coverage of the analysis and compare the relationship between the real exchange rate and employment in the G7 countries.

[3] Tomiura (2004) also studies the relationship between import competition and job creation/destruction using longitudinal data on Japanese manufacturing industries at the four-digit level from 1988 to 1993. He concludes that the changes in import prices had significant effects on job creation/destruction, mainly associated with plant start-ups/shutdowns and plant transfers from/to other four-digit industries. Because the related studies by Tachibanaki *et al.* (1998) or Rebick (1999) employ data at the two-digit industry level, neither finds a clear relationship between import ratios and employment. In a recent study of the period after the mid 1990s, Ito (2005) studies the determinants of the growth rates of sales and/or employment using individual firm data from the *Basic Survey of Japanese Business Structure and Activities* compiled by the Ministry of Economy, Trade, and Industry (METI). The results indicate that the growth rates of sales and/or employment are likely to be low in industries that have faced severe competition from products imported from low- or middle-income countries. Moreover, Ito and Fukao (2005) empirically examine the effects of changes in the trade structure in Japan on domestic factor markets. They find that trade has shifted the pattern of specialization to the export of physical capital or skilled labor-intensive products since the 1990s.

has rapidly expanded since the mid 1990s, and it is easily conjectured that the intensification of import competition has somewhat affected the domestic labor market during this period. Hence, it is considered to be extremely important to investigate the effects of import competition to understand the severe employment situation that has existed in Japan since the 1990s. Second, the analysis makes the best use of the longitudinal data available on Japanese manufacturing industries at the four-digit level, as in Tomiura (2003). With recent developments in the international division of labor, industries have specialized in either exporting or importing within the same industrial sector. In this regard, it is supposed that industries that belong to the same industrial sector should be affected by import competition in varying degrees. Therefore, we attempt to explore the effects of import competition by employing longitudinal data on disaggregated industries.[4]

The remainder of this paper is organized as follows. In Section 2, we present a theoretical model to derive the labor demand equation of a domestic industry facing import competition and clarify the relationship between import prices and employment in that industry. In Section 3, we discuss the adequate industrial classification for analyzing the effects of import competition and give an account of the longitudinal data on manufacturing industries in Japan used in our study. In Section 4, the framework of the econometric model is detailed and we discuss how the "import-competing" industries are selected from total manufacturing as the subjects of our study. In Section 5, we interpret the results of our empirical study. Section 6 presents the conclusions.

2. THEORETICAL FRAMEWORK

In this section, we present a standard model to derive the labor demand equation of a domestic industry facing import competition, and clarify the relationship between import prices and domestic employment in the industry. Section 2.1 describes the production function of the domestic industry and the demand function for the products, both of which are postulated to derive the labor demand equation. Section 2.2 makes clear the relationship between our hypothesis testing and the derived labor demand equation.

2.1. *Assumption*

In this section, we assume a domestic industry confronted with import competition: an "import-competing industry" hereafter. Furthermore, the classification of the industry

[4] Firm-level data have some defects when compared with disaggregated industry-level data: (1) it is generally difficult to capture transactions between firm's headquarters and their affiliates, and domestic production activities in multinational companies; (2) it can also be difficult to sort the activities of management and production divisions into parts. We can avoid, to some extent, these problems by using data on disaggregated industries based on the annual survey of domestic establishments in the *Census of Manufactures*.

is based not on industrial sectors such as “Textiles” or “Electrical machinery,” but more on the disaggregated industries included in these industrial sectors; e.g., the “Shirts” and “Ties” industries in the “Textile” sector, or “Industrial process controlling instruments” or “Semiconductor devices” industries in the “Electrical machinery” sector. The reason to assume disaggregated industries is that, as discussed in the previous section, industries belonging to the same industrial sector are affected by import competition to varying degrees when combined with recent developments in the international division of labor.

The domestic industry produces a kind of product with labor input L_t and nonlabor input R_t at period t. The quantity of product is denoted as Q_t, and its production function is assumed to have a Cobb–Douglas form:

$$Q_t = AL_t^{\alpha} R_t^{1-\alpha}, \tag{2-1}$$

where α is the parameter denoting the labor coefficient (with $0 < \alpha < 1$), and A represents an unobservable production efficiency of the industry.

In addition, consider the demand side of the domestic industry by defining the demand function for the product as:

$$Q_t = \mathrm{B} \left(\frac{p_t}{p_t^m} \right)^{-\gamma} \left(\frac{p_t}{\overline{p}_t} \right)^{-\eta} y_t, \tag{2-2}$$

where p_t is the price of the product supplied by the domestic industry, p_t^m is the import price of the product supplied by the foreign competing industry in terms of the home country’s currency, $\overline{p}_t$ is the aggregate basket price of domestic products, y_t is the income factor, B is other factors shifting demand. Both γ and η are parameters, which satisfy $\gamma > 0$ and $\eta > 0$, respectively. For simplicity, the income elasticity of demand in (2-2) is assumed to be unity.

Equation (2-2) is based on the assumption that the product supplied by the domestic industry is an imperfect substitute for both the product supplied by the foreign competing industry and the aggregate basket of domestic products. In this respect, while both γ and η correspond to the price elasticity of product demand, they also represent the degrees of substitution between the product of the domestic industry and the product of the foreign competing industry or the aggregate basket of domestic products; see Appendix A for details of the consumer behavior in (2-2). Moreover, the domestic industry is assumed unable to control p_t^m and $\overline{p}_t$; i.e., both prices are exogenously given.

Finally, the domestic industry is also assumed to be a price taker in factor markets; that is, both the wage, w_t, and the nonlabor input price, c_t, are determined exogenously. In fact, business establishments, firms, and disaggregated industries are usually regarded as being unable to set their wages; see Hamermesh (1993), Chapter 2, for the related discussion. Furthermore, it may also be plausible to presume that nonlabor input prices, such as the prices of material, energy, intermediate goods, and capital, are exogenously determined.

2.2. *Derivation of the labor demand equation*

Under the above settings, the domestic industry maximizes its profits by solving the following maximization problem:

$$\underbrace{Max}_{L_t, R_t} \pi_t = p_t(Q_t)Q_t - (w_t L_t + r_t R_t),$$

s.t. (2-1) and (2-2).

For simplicity, various adjustment costs and dynamic aspects pertaining to the optimization are not allowed here. We plug (2-1) and (2-2) into π_t to delete p_t and Q_t, and set the first-order conditions of the maximization problem as follows:

$$\frac{\partial \pi_t}{\partial L_t} = w_t,$$

$$\frac{\partial \pi_t}{\partial R_t} = c_t.$$

Deleting R_t from the first-order conditions and taking its logarithm yields the optimal level of labor demand, i.e., $\ln L_t^*$, as follows:

$$\ln L_t^* = \Omega + \theta_1 \ln w_t + \theta_2 \ln c_t + \gamma \ln p_t^m + \eta \ln \overline{p}_t + \ln y_t + \Phi, \quad (2\text{-}3)$$

where Ω is the constant term consisting of α, γ, and η; Φ is the industry-specific effects consisting of A, B, and other parameters.[5] Furthermore, θ_1 and θ_2 represent the parameters expressing the elasticities of labor demand with respect to factor prices, which can be described as:

$$\theta_1 = -\{1 + \alpha(\gamma + \eta - 1)\},$$

$$\theta_2 = -(1-\alpha)(\gamma + \eta - 1).$$

The expected signs of θ_1 and θ_2 need to be discussed. The sign of the wage

[5] Strictly speaking, both Ω and Φ can be represented by the following forms:

$$\Omega = (\gamma+\eta)\ln\alpha(1 - \frac{1}{\gamma+\eta}) - (\gamma+\eta-1)(1-\alpha)\ln(\frac{\alpha}{1-\alpha}),$$

$$\Phi = \ln \mathrm{B} - (\gamma+\eta-1)\ln A.$$

parameter, θ_1, should be negative, implying that labor demand decreases as the wage increases. The sign of the nonlabor input price parameter, θ_2, depends on the relative magnitudes of the substitution and scale effects. The former corresponds to the increase in labor inputs to maintain a given quantity of output against the increase in nonlabor input prices, while the latter addresses the decrease in labor inputs with a fall in the output quantity by imputing the additional cost caused by an increase in the nonlabor input price to the product price.[6]

Most interest in this paper lies in γ, i.e., the parameter on p_t^m, which is equivalent to the elasticity of product demand with respect to the import price in (2-2). The positive sign of γ supports our hypothesis that the intensified import competition brought about by the fall in the import price should cause the decline in employment in the domestic industry. In other words, the larger is γ, the more competitive the product market, and the more sensitive the decrease in employment to a fall in the import price. In the remainder of the study, we estimate the specification of the labor demand equation by employing data on Japanese manufacturing industries, and test the hypothesis that a fall in the import price is closely related to the employment decline in Japanese manufacturing, i.e., $\gamma > 0$ on the right-hand side of (2-3).[7]

3. DATA

In this section, we present the data employed in our empirical study. First, in Section 3.1, we define an adequate industrial classification for analyzing the effects of import competition. Following this, Section 3.2 describes the longitudinal data on the manufacturing industries employed in our study.

3.1. *Industrial classification*

We first present an adequate industrial classification of the manufacturing industry data used to estimate the labor demand equation.

Japan's enterprises have been engaged in erecting a global production network in developing countries, revolving around the Asian region, since the 1990s. This global production network has developed as a system of the international division of labor based on many production blocks subdivided from a long production process. Consequently, even within the same industrial sector, some industries have come to specialize in

[6] Because a Cobb–Douglas functional form is assumed in (2-1), the elasticity of substitution with respect to each input factor is always equivalent to unity. Moreover, the demand elasticity with respect to the price of the domestic product, $(\gamma + \eta)$, must exceed unity for the marginal revenue of the domestic industry to be positive. Taking this into account, the sign on θ_2 should ordinarily be negative.

[7] Although trade in intermediate products has recently increased in Japan, our model does not explicitly deal with their effects on domestic employment. See Feenstra (2004), Chapter 4, for a formal analysis of the effects of the trade of intermediate products on domestic employment and wages.

exporting products, while others specialize in importing products. [8] In such an environment, the effects of import competition can vary depending on the industry, even if they belong to the same industrial sector.

To verify the abovementioned point, we investigate the differences in import ratios of disaggregated industries within the same industrial sector using data on Japanese manufacturing industries at the four-digit level. As the import ratios of industries at the four-digit level are not available in existing statistics, we prepare them by matching import codes in the *Japan Exports & Imports – Country by Commodity* compiled by the Japan Tariff Association to the corresponding four-digit industries. See Appendix B for the procedure. As a result, the import ratios of a total of 354 manufacturing industries are obtained. The import ratios of the four-digit classified industries are allocated to their corresponding two-digit industrial sectors, and subsequently, the standard deviations of the import ratios in the respective industrial sectors are calculated.

Table 1 shows the standard deviations of the import ratios in each industrial sector in 1995, 1999, and 2003. As shown, the standard deviations of import ratios in almost all industrial sectors have certain amounts by magnitude although they differ, to some extent, by sector. This suggests that the effects of import competition should vary depending on the industries, even if they belong to the same industrial sector. In other words, the industries have faced different market conditions, even though they are classified in the same industrial sector. Furthermore, the standard deviations become larger from 1995 to 2003, and this tendency is clearly observed in several industrial sectors, such as "Textiles," "Furniture & Fixtures," "Leather & Fur," "Ceramics, Stones & Clay," "General Machinery," "Electrical Machinery," and "Precision Instruments," and so on. This is considered to reflect recent progress in the international division of labor. Considering this, in studying the effects of import competition, data on disaggregated industries at the four-digit level is thought to be more desirable than data at the two-digit level, such as "Textiles" or "Electrical Machinery."

In addition, Table 1 also shows the average values of import ratios by industrial sector. The main feature is that the average import ratios of many industrial sectors increased during 1995–2003, suggesting that import competition may have intensified since the mid 1990s.

3.2. *Data of empirical study*

Taking account of the analysis in Section 3.1, we apply the data on Japan's

[8] In a related study, Sasaki and Koga (2005) examined intra-industry trade patterns in the Japanese machinery sector using disaggregated data consisting of export and import commodities classified with six-digit HS codes. They report that the share of vertical intra-industry trade, i.e., the two-way trade of products differentiated by their qualities, increased significantly in the 1990s and that this is most prominently observed in trade with Asian countries.

manufacturing industries at the four-digit level from the *Census of Manufactures* compiled by METI: complete panel data, consisting of 354 manufacturing industries during the period 1994–2003. The data are based on the annual survey on activities of Japan's domestic establishments, and have the advantage of covering a wide range of production activities of disaggregated industries in the entire manufacturing sector. For example, about 40 industries, such as "Electron tubes," "Semiconductor devices," "Integrated circuits," and "Electro acoustic transducers, magnetic heads and small motors," are included in the "Electrical machinery, equipment and supplies" two-digit industrial sector. In the *Census of Manufactures*, we can acquire information on employment, production, and the shipments of these disaggregated industries.

This analysis focuses on the period 1994–2003 for the following reasons. First, the existing literature, including Dekle (1998) and Tomiura (2003), analyzed the period before the early 1990s, and no studies have so far attempted to investigate the period after the mid 1990s. During this period, the value of imports from Asian countries increased rapidly, as shown in Figure 1(2). This may have resulted in intensified import competition in some manufacturing industries. Second, the industrial classification in the *Census of Manufactures* was altered in 1994, such that industries included in industrial sectors such as "Apparel and other finished products made from fabrics and similar materials" and "Electrical machinery, equipment, and supplies" were more disaggregated than before.[9]

The *Census of Manufactures*, however, offers neither the import prices nor the nonlabor input prices of the disaggregated industries, although both are indispensable for the following analysis. Therefore, we construct the import prices of these industries by matching the import price indices of the *Corporate Goods Price Index*, compiled by the Bank of Japan (BOJ), to the corresponding industries at the four-digit level in the *Census of Manufactures*. Practically speaking, these are made by employing the import price indices approximately corresponding to the four-digit industries (that is, the import price indices by "Group," i.e., the most rough product classification, "Subgroup," "Commodity class," or "Commodity" classification) matched in order to the corresponding four-digit classified industries. Moreover, when more than two import price indices are associated with the same industry, the import price of the industry is constructed by weighting the import price indices by their corresponding import values in 2000.

Next, the input price index in the *Input–Output Price Index of the Manufacturing Industry by Sector* of the BOJ is used to construct the nonlabor input prices for each

[9] Recombination of the industrial classifications in the *Census of Manufactures* was undertaken twice after 1994 (1999 and 2002). In particular, industries that used to be included in "Manufacture of Electrical Machinery, Equipment, and Supplies," were upgraded to two-digit classified industries as both "Manufacture of Information and Communication Electronics Equipment" and "Electronic Parts and Devices." See METI's website (http://www.meti.go.jp/statistics/kougyou/kaitei-14/) for details of the recombination. The post-1994 data in this paper are prepared using the necessary adjustments for the recombination of industrial classifications.

industry. The cost of capital, strictly speaking, should also be included in nonlabor input prices; it is, however, difficult to obtain so is not included. The program prepared by the BOJ is used to construct the input price indices of the four-digit classified industries. These are matched to their corresponding industries and specified as the nonlabor input price.[10]

4. EMPIRICAL STUDY

This section gives an account of the procedures used in the empirical analysis. Section 4.1 explains the econometric specification of the labor demand equation, the definitions of the variables employed in the estimates, and the econometric method. Section 4.2 details how the import-competing industries that constitute the sample are selected.

4.1. *Econometric model*

(1) Econometric specification

To investigate the effects of import competition, we estimate the specification on the reduced form of labor demand equation derived in Section 2 using the Japanese manufacturing industry data. According to (2-3), the optimal employment level of the domestic industry i facing import competition in period t, $\ln L_{it}^{*}$, is derived from its profit maximization, expressed as the following equation:

$$\ln L_{it}^{*} = \Omega + \theta_1 \ln w_{it} + \theta_2 \ln c_{it} + \gamma \ln p_{it}^{m} + \eta \ln \overline{p}_t + \ln y_t + \Phi_i , \tag{4-1}$$

where i is the subscript of the domestic industry. The income term without an industrial subscript, $\ln y_t$, indicates that all domestic industries encounter the same income situation.

In this stage of the estimation procedure, we do not directly estimate (4-1). Instead, we add some modifications to estimate a more flexible form of labor demand equation. First, the optimal level of employment in (4-1) is derived from the profit maximization behavior of the domestic industry where the employment is assumed to adjust instantaneously. However, employment is, in reality, unlikely to adjust smoothly because of adjustment costs in firm-specific human capital, hiring and/or firing, and so on. Taking account of these aspects, we specify a partial labor adjustment model. The basic idea is that an actual amount of labor adjustment in a certain period remains at a fraction of the

[10] It is thus impossible to strictly match both import and input price indices to the corresponding four-digit classified industries. In this sense, our approach may only be an approximation. A detailed list of the correspondence between industries and price indices is available upon request from the author. The program for input price indices in the *Input–Output Price Index of the Manufacturing Industry by Sector* prepared by the BOJ is available on its website (http://www.boj.or.jp/theme/research/stat/pi/iopi/index.htm).

optimal amount of labor adjustment because of the various adjustment costs.[11] The amount of actual labor adjustment from $t-1$ to t period, $\Delta \ln L_{it}$, is simply expressed as the following equation:

$$\Delta \ln L_{it} = \lambda(\ln L_{it}^* - \ln L_{it-1}), \tag{4-2}$$

where λ is a parameter denoting the speed of labor adjustment (with $0 \le \lambda \le 1$).

The above specification shows that the actual employment adjustment to its desired level, $\ln L_{it}^*$ in (4-1), is undertaken more rapidly as λ approaches unity. Meanwhile, as λ becomes closer to zero, the speed of labor adjustment is slower. From (4-1) and (4-2), the actual level of employment in period t, $\ln L_{it}$, is expressed by its one-period lag, $\ln L_{it-1}$, and the variables which determine the desired level of employment, i.e., the variables on the right-hand side of (4-1). The parameter on $\ln L_{it-1}$, $(1-\lambda)$, signifies the speed of labor adjustment.[12]

Further, the labor adjustment process is generally expected to vary with workers' characteristics, e.g., it depends on whether they are skilled or unskilled workers. According to previous work, it has been suggested that a two-period lagged dependent variable should be included as an explanatory variable in the labor demand equation, when aggregate employment, consisting of both skilled and unskilled workers, is estimated (see Appendix C for a more detailed discussion). The "regular workers" in our analysis comprise aggregated workers and are not classified by their characteristics. Hence, we estimate the labor demand equation by including one- and two-period lags of the dependent variable among the explanatory variables, thereby taking into account the different labor adjustments of these workers.

Finally, Φ_i is captured by the individual effects, η_i, and both $\ln \overline{p}_t$ and $\ln y_t$ are absorbed by the time effects, ν_t.[13]

The econometric specification with the above modifications is represented as the following equation:

$$\ln L_{it} = \delta + \beta_{11} \ln L_{it-1} + \beta_{12} \ln L_{it-2} + \beta_2 \ln w_{it} + \beta_3 \ln c_{it} + \beta_4 \ln p_{it}^m + \eta_i + \nu_t + \varepsilon_{it}, \tag{4-3}$$

[11] Many previous studies estimate labor demand equations derived on the assumption of either partial labor adjustment models or quadratic labor adjustment costs. However, according to some recent work, it has been made clear that the costs of labor adjustment in microsectors, such as in establishments or firms, are partially linear and asymmetric in part with fixed costs; see, for example, Cahuc and Zylberberg (2004), p. 231 or Cooper *et al.* (2004). Neither specification based on the partial labor adjustment model nor quadratic labor adjustment model can deal with such labor adjustment properties. In this respect, the model in this paper could be exposed to some criticism. We leave this for future research.

[12] Plugging (4-1) into (4-2), the current level of employment, $\ln L_{it}$, is denoted as:

$$\ln L_{it} = (1-\lambda)\ln L_{it-1} + \lambda \ln L_{it}^*.$$

[13] Cost of capital is not included in the input price index, i.e., a proxy variable of c_{it}. However, on the assumption that all industries face a common cost of capital, ν_t in (4-3), this could be expected to control for its effect.

where δ is the constant term; β are the parameters; η_i is the individual effects by industry; ν_t is the time effects; and ε_{it} is the error term, i.e., the idiosyncratic shock.

(2) Data for econometric analysis

The definitions and sources of the variables used in the estimations are as follows:

- Regular workers (L_{it}): the sum of regular workers, loaned or/and dispatched workers and part-time workers from the *Census of Manufactures*. Sole proprietors, unpaid family workers, and temporary employees are not included.
- Real wage per capita (w_{it}): the total cash wages and salaries of regular workers, deflated by the aggregate consumer price index, divided by the number of regular workers. These are from the *Census of Manufactures* and the *Consumer Price Index* of the Statistics Bureau, Ministry of Internal Affairs and Communications.
- Input price index (c_{it}): the input price index by industry from the *Input–Output Price Index of the Manufacturing Industry by Sector*, deflated by the aggregate corporate goods price index from the *Corporate Goods Price Index* of the BOJ.
- Import price index (p_{it}^m): the import price index (on a yen basis) by industry, deflated by the aggregate corporate goods price index. Both are from the BOJ's *Corporate Goods Price Index*.

(3) Estimation method

We need to be aware of two problems in estimating (4-3). The first problem is how to treat the two lagged dependent variables on the right-hand side of (4-3). As these are necessarily correlated with η_i, conventional estimation of (4-3) generated a simultaneity bias in the parameter estimates of these variables. The second problem is that a simultaneity bias exists in the parameter estimate of $\ln w_{it}$ in (4-3). As data on working hours and workers' composition are not available in the *Census of Manufactures*, an average wage rate per capita is specified as the cost of labor. Hence, $\ln w_{it}$ may have a correlation with ε_{it}, which includes a demand shock in the current period t. In this regard, the hours of workers generally move procyclically, resulting in an upward bias in β_2. Conversely, if the ratio of skilled to unskilled workers within an industry fluctuates countercyclically, i.e., the composition effects, then it results in a downward bias in β_2; see Nickell and Wadhani (1991) for the details.

To avoid the problems stemming from the simultaneity bias, we estimate the first-differenced form of (4-3), where η_i is eliminated, by dynamic Generalized Method of Moments ("dynamic GMM" hereafter); see Arellano and Bond (1991) for the framework and practical estimation procedure. The instrumental variables applied in the dynamic GMM are as follows:

- The simultaneity bias caused by the correlation between the lagged dependent variables and η_i is dealt with the instruments of the more than two-period lagged dependent variable, i.e.,

$\ln L_{it-2}$, $\ln L_{it-3}$, …, following the dynamic GMM procedure.

- The simultaneity bias caused by the correlation between the wage variable and the error term is dealt with in the instruments of the more than two-period lagged wage variable, i.e., $\ln w_{it-2}$, $\ln w_{it-3}$, …, and two- and three-period lags of the changes in the corporate goods price of industrial sector j, i.e., $\Delta \ln CP_{jt-2}$ and $\Delta \ln CP_{jt-3}$, both from the *Corporate Goods Price Index*.

4.2. *Choice of import-competing industries*

In the previous section, we observed that the import ratios of manufacturing industries at the four-digit level vary, even within the same industrial sector. This suggests that the effects of import competition could differ depending on the industry, even if they belong to the same industrial sector. Hence, we estimate (4-3) by employing data on import-competing industries sorted from 354 manufacturing industries in the previous section.[14] We state the ideas and practical procedure used in selecting these import-competing industries below.

Japan has imported cheap labor-intensive products, especially from Asia, since the 1990s. Because Asian countries have a comparative advantage from their cheap and abundant labor forces, we suggest that domestic industries producing products competing with these products are affected most severely by import competition. In this regard, we need to sort those industries with both high labor shares and high import ratios (import-competing industries) from the total number of manufacturing industries.[15] In terms of the empirical analysis, as the parameters on the independent variables in (2-3) consist of α, γ, and η, it is desirable to pool the sample industries assumed to face identical parameters. In this sense, the approach to sort, *ex ante*, the industries with high labor shares and high import ratios as "import-competing industries" from total manufacturing and carry out the estimation using data on the selected industries is justified.

We now explain how to select the import-competing industries. First, the labor shares of the 354 manufacturing industries are calculated as the average ratio of total cash wages and salaries to value added from 1994 to 2003. The labor shares and import ratios are then plotted in a scatter diagram. As shown in Figure 2(1), industries with higher import ratios are likely to have higher labor shares. This is consistent with our hypothesis

[14] According to the ranking of import ratios by industry in Table 2, while "Textile" or "Apparel and textile products" industries, e.g., "Small leather cases," "Sweaters," or "Knitted garments and shirts," are placed at the head of a ranking, domestic food industries including "Rice cleaning and polishing" or "Sake (Japanese rice wine),", or ceramic industries etc. are placed in a lower position. Hence, although all of those industries are regarded as a manufacturing sector regardless of the level of their import ratios, the industries confront different market conditions. This means that it is not desirable to estimate the labor demand equation by pooling the sample of manufacturing industries together.

[15] If we assumed competition only with products imported from Asian countries, an alternative would be to use the import ratios calculated from the import values from Asian countries to select the import-competing industries. However, as we do not *a priori* exclude the possibility of competition with products imported from developed countries, import ratios based on the total import values are used in this study.

that industries with higher labor shares, i.e., labor-intensive industries, have so far faced intensified import competition. To select the import-competing industries, we focus attention on the average values of labor shares (0.4) and import ratios (0.2) for all manufacturing industries, as shown in Figure 2(2), respectively. Subsequently, those industries with labor shares and import ratios above these average values are designated as baseline import-competing industries. As a result, 57 import-competing industries are selected, and the labor demand equation (4-3) is estimated using data on these industries as a baseline estimate. In addition, the estimation is also implemented with the use of a subsample of industries selected on the basis of the labor share and import ratio by lowering every 0.1 point from the above baseline levels, and specifying in which subsample the effects of import competition are observed.

Before giving details of the estimation results, the descriptive statistics of the baseline import-competing industries are shown in Table 3. First, regular workers in import-competing industries decrease on average, and the rate of decrease, i.e., −6.9 percent on average annually, is greater than for regular workers in all manufacturing industries, i.e., −3.5 percent. In addition, the average import ratio of import-competing industries, i.e., 0.45, exceeds that of all industries, i.e., 0.15; the average rate of increase of import-competing industries is also larger than that for all manufacturing industries. These features seem to be consistent with our hypothesis that the import-competing industries have been exposed since the 1990s to a more competitive environment.

5. ESTIMATION RESULTS

This section presents our empirical results. Section 5.1 shows the estimation results using the data on baseline import-competing industries.[16] Section 5.2 describes the subsample estimation results, and indicates the types of industries affected by import competition. Finally, Section 5.3 evaluates the quantitative effects of import competition on Japan's manufacturing employment.

5.1. *Baseline estimation*

Column (1) in Table 4(1) is the dynamic GMM estimation result of equation (4-3) using the data on baseline import-competing industries in Section 4.2. The parameter on import price, which is of most interest in this analysis, is estimated to be positive and statistically significant, supporting our hypothesis that the change in import prices has substantially affected employment. Furthermore, the parameters on the lagged dependent variables are also estimated to be statistically significant, suggesting that the labor adjustments in Japan's import-competing industries have been sluggish. The parameter on wage is also estimated to be negative and statistically significant, suggesting that labor

[16] The estimations in this paper are made with *DPD for OX*; see Doornik *et al.* (2002).

demand decreases as wages increase. Finally, the parameter on nonlabor input price is not found to be statistically significant because of the large standard errors. This should be interpreted as indicating that the substitution effects have been reversed with the scale effects by industry, as discussed in Section 2.

To implement robustness tests for the above estimation results, column (2) in Table 4(1) shows the estimation result of the labor demand equation without the nonlabor input price term, which is ascertained to be statistically insignificant in column (1). This should be interpreted as meaning that all industries face common nonlabor input prices, whose effects are considered to be absorbed in v_t in (4-3). According to the result, the parameter on the import price in column (2) is estimated to be positive and statistically significant, although it slightly exceeds the parameter on the import price in column (1). Other than this, we hardly find any differences between the two sets of estimation results.

For evaluating the appropriateness of the estimation method, the overidentified restrictions on the validity of the instrumental variable in dynamic GMM estimation are satisfied according to results of the Sargan test. Moreover, nonautocorrelation in ε_{it} is a necessary condition for obtaining consistent parameter estimates by dynamic GMM. In this respect, the results of the statistical test regarding the second-order serial correlation in ε_{it} supposed by Arellano and Bond (1991), i.e., m_2 test, support the hypothesis of no serial correlation in ε_{it}.

We have also estimated the same specification of labor demand equation using the 297 manufacturing industries obtained when the 57 import-competing industries are removed from total 354 manufacturing industries. It is clear in columns (3) and (4) in Table 4(1) that the parameter estimate on import price is not statistically different from zero. This suggests that the effects of import competition are primarily observed in import-competing industries.

5.2. *Subsample estimation*

We next undertake subsample estimates of the labor demand equation. Practically, we implement the estimation by employing the data of the import-competing industries by lowering the selection criteria for labor shares and import ratios by 0.1 point from the baseline levels of labor shares (0.4) and import ratios (0.2). As a result, the parameters on the import price, i.e., the import price elasticity, are estimated in the respective subsample estimates. In the subsample estimates, the parameters on nonlabor input prices are not statistically significant so the following discussion is based on the estimation results where the term of nonlabor input price is excluded from the specification of labor demand equation; see the “Reference” accompanying Table 4 for details of subsample estimation results.[17]

[17] For the robustness check, we have also undertaken subsample estimates with a specification including

According to Table 4(2), the estimated values of import price elasticity approach zero as both the labor shares and the import ratios are lowered to sort the subsample industries from the baseline criteria.[18] The values for the import price elasticity are statistically significant at the 5 percent level only when we use data on the 57 industries with a baseline criterion of labor share (0.4) and import ratio (0.2), and data consisting of the 76 industries with the criteria of labor share (0.3) and import ratio (0.2).

What kinds of industries are included in the subsamples where the effects of import competition are found to be statistically significant? Table 5(1) depicts the shares of industrial sectors to which these import-competing industries belong. The first feature in Table 5(1) is that the shares of these industries are larger in both the "Textile" and the "Miscellaneous" sectors. This is consistent with the fact that the import of light manufacturing products, including cheap and abundant textile products or miscellaneous goods, from Asian countries, particularly mainland China, have increased since the 1990s. The second feature is that these import-competing industries also belong to diverse industrial sectors. According to the list of import-competing industries in Table 5(2), for example, industries such as "Miscellaneous electrical machinery equipment and supplies," "Medical measuring instruments," "Motion picture equipment and their parts," and "Watches, clocks and parts, except watchcases" are included among the import-competing industries. These results indicate that even within the same industrial sector, some industries specialize in exports while others specialize in imports. Hence, our approach in this paper may be justified in the sense that the effects of import competition are investigated using the data on manufacturing industries at the four-digit level, thereby controlling for the characteristics or heterogeneities of disaggregated industries.

5.3. *Quantitative effects of import competition*

Finally, we evaluate the quantitative effects of the change in import prices on Japan's manufacturing employment. From column (2) in Table 4(1), the import price elasticity of the baseline estimate is found to be about 0.6. This implies that employment declines by approximately 0.6 percent *in the short run* when import price decreases by 1 percent.

However, the change in import prices affects both current and future employment through the dynamics of labor adjustment. We thus attempt to measure the *long-run* effects of the changes in the import price on employment by using both the *short-run* import price elasticity (0.6) and the parameter estimates on the lagged dependent

a nonlabor input price in labor demand equation; it is confirmed that the estimation results are almost the same as those reported here in the qualitative sense.

[18] If the selection criteria of labor share and import price were, conversely, augmented to narrow down the import-competing industries, we could not secure sufficient degrees of freedom to obtain reliable estimation results. See Hayashi (2000) for small sample properties of the GMM efficient estimator.

variables in column (2) in Table 4(1). From this simple calculation,[19] it is found that employment declines by 1.5 percent in total when import prices decrease by 1 percent. In addition, we calculate the ratio of employment in import-competing industries to total manufacturing employment. The finding is that the employment ratios of the 52 and 76 import-competing industries, i.e., the baseline and subsample import-competing industries in Section 5.2, to total employment in the total 354 manufacturing industries are less than 10 percent, i.e., 6.2 and 9.3 percent on average during the period 1994–2003, respectively. Considering these results, it seems exaggerated to say that the intensified import competition since the latter half of the 1990s has seriously affected the employment of manufacturing industries in Japan. Rather, it has significantly influenced the employment of the labor-intensive industries exposed to the severe import competition.[20]

6. CONCLUDING REMARKS

This paper has examined the effects of increased import competition on manufacturing employment in Japan. In particular, we have investigated whether the change in import prices has substantially affected regular employment using data on manufacturing industries at the four-digit level since the mid 1990s.

According to the empirical results of the labor demand equation, the decline in import prices is closely related to falls in employment in import-competing industries, defined as industries with high labor shares and import ratios. In this respect, it is conjectured that these industries have a comparative advantage in labor-intensive production, and consequently, have been inevitably confronted with severe competition in their product markets, especially from large increases in trade with neighboring Asian

[19] The *long-run* effect of import price change signifies the total change in current and future employment when the import price changes by 1 percent now. In this analysis, it is calculated using the parameter estimates of the lagged dependent variables and the import price variable in (4-3), i.e., $\hat{\beta}_{11}$, $\hat{\beta}_{12}$, and $\hat{\beta}_4$ from column (2) in Table 4(1), respectively, using the following formulation:

$$\frac{\hat{\beta}_4}{(1-\hat{\beta}_{11}-\hat{\beta}_{12})}=\frac{0.605}{(1-0.454-0.139)}\cong 1.5\,.$$

[20] Tomiura (2003) works out the import price elasticity using data for all manufacturing industries in order to verify the quantitative impacts of import competition. The analysis reports an import price elasticity of about 1.25 *in the short run* evaluated at the average import ratio of 27 percent, which is equivalent to the sum of the average import price value of 390 manufacturing industries during 1993–1995 plus one standard deviation. In this respect, since we have, *a priori*, selected import-competing industries from total manufacturing industries, and calculated the import price elasticity for these industries, it is difficult to compare directly the results of this analysis with those reported in Tomiura (2003). However, while employment was relatively protected during the period 1993–1995, despite the sharp downturn in import prices from the yen appreciation, substantial employment adjustment has been undertaken since the latter half of the 1990s, although import prices have declined less when compared to the earlier period. Based on these observations, the quantitative impact of recent import competition may have strengthened more than before, even after considering other factors.

countries. Further, these import-competing industries include not only industries categorized in either the "Textile" or the "Miscellaneous" sectors, but also those that belong to various other industrial sectors, including the "Machinery" sector. These results suggest that the effects of import competition vary across industries, even for those in the same industrial sector. In this respect, our approach in this paper may be justified in the sense that the effects of import competition are investigated using data on disaggregated industries at the four-digit level, which helps controls for their characteristics or heterogeneities.

In sum, it is concluded that import competition should be considered as an important factor explaining the severe employment condition existing in Japan since the 1990s. As it is highly likely that international competition will become more intensive in the future in line with further advances in economic globalization, it remains an important challenge to create new jobs by originating value-added through the preferential allocation of economic resources into fields in which Japan has an international advantage.

APPENDIX A

Assume, for a simple example, a CES consumer's utility function for domestically supplied product, Q, and foreign supplied products, Q_m. The consumer's utility maximization problem is represented as:

$$\underbrace{Max}_{Q,Q_m}\, u = (a_d Q^{\rho} + a_m Q_m^{\rho})^{\frac{1}{\rho}}, \qquad a_d > 0,\ a_m > 0,\ 0 < \rho < 1,$$

$$\text{s.t. } pQ + p_m Q_m = y,$$

where both p and p_m are prices of domestic and foreign products; y is the consumer's income; and a_d, a_m, and ρ are parameters.

The optimal levels of demands for Q and Q_m are represented as:

$$Q^* = \frac{a_d^{\gamma} p^{-\gamma} y}{(a_d^{\gamma} p^{1-\gamma} + a_m^{\gamma} p_m^{1-\gamma})}, \tag{A1}$$

$$Q_m^* = \frac{a_m^{\gamma} p_m^{-\gamma} y}{(a_d^{\gamma} p^{1-\gamma} + a_m^{\gamma} p_m^{1-\gamma})},$$

where γ denotes the elasticity of substitution between Q and Q_m, i.e., $\gamma = 1/(1-\rho)$.

According to (A1), Q^* is a decreasing function of p, and an increasing function of p_m and y; in addition, ceteris paribus, as its price elasticity becomes larger, the higher is γ.

Based on the above properties, set up again the optimal level of demand for domestic product as a function of a relative price of domestic and foreign products and consumer's income, where its price elasticity is equal to γ as the following expression:

$$Q^{*} = \mathrm{B}\left(\frac{p}{p_m}\right)^{-\gamma} y \,. \tag{A2}$$

B on the right-hand side of (A2) is considered to consist of parameters such as a_d, a_m, and γ, all of which define the consumer's tastes. In this respect, it should be interpreted as a demand shift factor other than price and income. (2-2) in Section 2 is defined as a demand function for domestic product, where the domestic product is assumed to be an imperfect substitute, not only for foreign products, but also for the aggregate basket of domestic products.

APPENDIX B

The import ratios of Japan's manufacturing industries at the four-digit level are based on the *Instruction of Weight Accounting* of the *Corporate Goods Price Index 2000*, which describes the matching relationships between the six-digit codes of classification in the *Census of Manufactures 2000* and nine-digit codes of classification in the *Japan Exports & Imports – Country by Commodity 2000*.

Our practical procedure is as follows:

<u>Calculation of import values by industry at the four-digit level</u>

- Import values from the 1994–2003 are from the *Trade Statistics of Japan* compiled by the Ministry of Finance (http://www.customs.go.jp/toukei/info/tsdl.htm).
- The matching relationships between six-digit codes and their corresponding nine-digit codes of export products in the *Census of Manufactures 2000* appear in the *Instruction of Weight Accounting*. We choose nine-digit codes of import products that are equivalent to these nine-digit codes of export products, and then make these codes of import products correspond to the six-digit codes in the *Census of Manufactures*.
- Those import values at the six-digit codes are aggregated to four-digit classified industries. If an identical nine-digit code of import product is classified across different industries, the product value is weighted by the shipment values of products of these different industries.
- The import values of these industries are finally deflated by their corresponding import price indices made up in Section 3.2.

<u>Calculation of shipment values by industry at the four-digit level</u>

- The shipment values of domestic industries at the four-digit level are worked using the combined information from the *Input–Output Table* 2000 and the *Census of Manufactures* 2000. The detailed procedure is as follows:
  - A) The domestic shipment value of total manufacturing in 2000 is calculated by subtracting the net increase in inventory from domestic production values of total manufacturing; both are obtained from the *Table on Transaction Valued at Producers' Prices* of the *Input–Output Table* 2000.
  - B) The total domestic shipment value is divided into different industries, according to their weights calculated from the shipment values of products by industry from the *Census of Manufactures* 2000.

C) The domestic shipment values in years other than 2000 are obtained by multiplying the growth rates of shipment values of products by industry from 2000 calculated from the *Census of Manufactures* by the domestic shipment values by industry in 2000 obtained in the A) and B) above.

D) The domestic shipment values by industry are deflated by the production deflators by economic activity in the *System of National Accounts* of the Cabinet Office.

Calculation of import ratios

- The import ratio of each industry is calculated using the import value and domestic shipment value in the above analysis. The ratio is defined as the import value divided by the sum of domestic shipment and import values.
- Finally, industries whose import values are less than one million yen, nontradable industries such as "Printing" or "Coating metal products," and industries with missing values in some years are excluded from the sample. As a result, data on 354 industries are finally prepared.

APPENDIX C

In this appendix, we explain that the lags of the dependent variable are added to the partial adjustment model with aggregation across different types of labors, on the basis of the discussion in Nickell (1984, 1986).

Assume that an industry holds both skilled labor, E_t^S, and unskilled labor, E_t^U, as labor inputs at period t, and both types of labor have different adjustment costs. The industry gradually adjusts both E_t^S and E_t^U to their desired levels. The partial adjustment model of both types of labor is shown by the following system:

$$(I - VL)\begin{bmatrix} E_t^S \\ E_t^U \end{bmatrix} = \mathrm{P}\begin{bmatrix} E_t^{S*} \\ E_t^{U*} \end{bmatrix},$$

where $[E_t^{S*}, E_t^{U*}]'$ is the desirable level of employment at period t; V is a (2×2) parameter matrix representing adjustment speeds of both E_t^S and E_t^U, i.e., $vecV = [v_{11}, v_{21}, v_{12}, v_{22}]'$; P is a (2×2) parameter matrix; and L denotes a lag operator.

Rewriting the above equation by using $(I - VL)^{-1} = (I - adj(V)L)/\det(I - VL)$ yields the following equation:

$$(1 - (v_{11} + v_{22})L + (v_{11}v_{22} - v_{12}v_{21})L^2)E_t = i'(I - adj(V)L)\mathrm{P}\begin{bmatrix} E_t^{S*} \\ E_t^{U*} \end{bmatrix},$$

where $i' = [1, 1]$ and $E_t \equiv E_t^S + E_t^U$.

Thus, the aggregation of different types of labor, both of which are assumed to have a one-period lag in the partial adjustment model, augments the number of lags in their aggregated labor, E_t. Furthermore, if the fluctuation of employment is not large enough, all variables included in the above equation can be approximated by their logarithms:

$$(1-(v_{11}+v_{22})L+(v_{11}v_{22}-v_{12}v_{21})L^2)\ln E_t = i'(I-adj(V)L)\mathrm{P}\begin{bmatrix}\ln E_t^{S*}\\ \ln E_t^{U*}\end{bmatrix}.$$

In this analysis, we include one- and two-period lags of the log-transformed dependent variables as explanatory variables in (4-3) to estimate the log-linearized labor demand equation.

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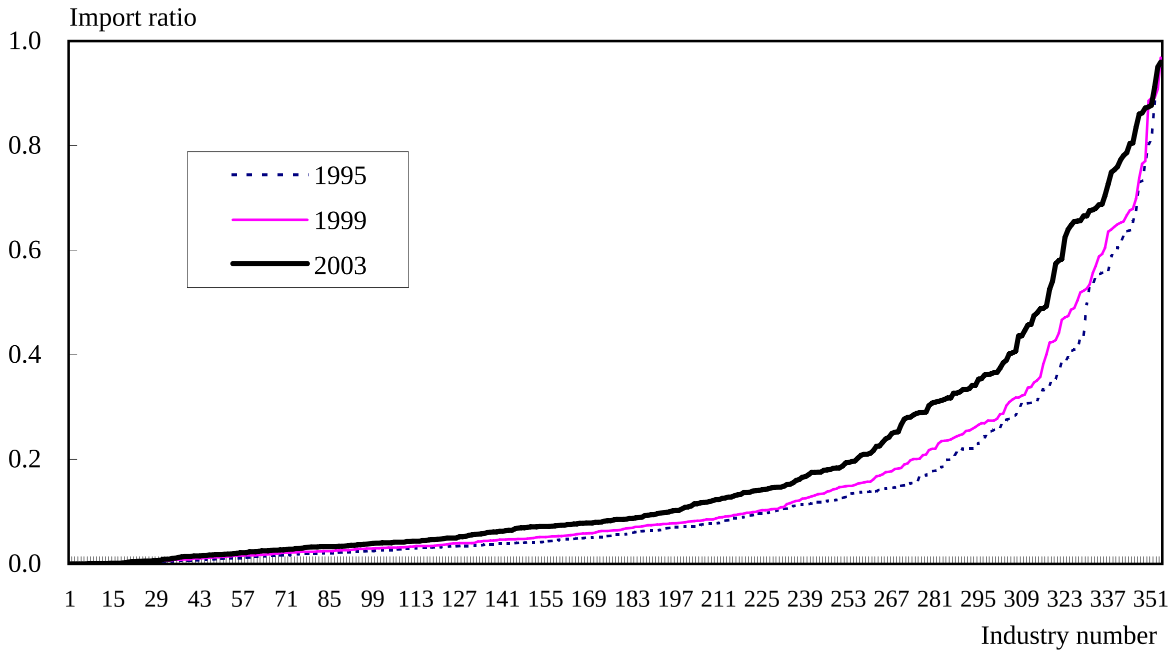
Table 1 : Import Ratios by Industries

		St. dev.			Average (%)		
		1995	1999	2003	1995	1999	2003
Total Manufacturing	(354)	17.89	19.07	22.27	12.86	14.35	18.19
Food	(28)	15.42	15.80	16.15	10.94	11.11	11.60
Beverages, Tobacco and Feedstuff	(12)	31.12	31.32	30.76	21.32	21.56	22.24
Textiles	(16)	11.63	16.39	19.15	16.38	19.20	26.18
Apparel & Textile	(22)	24.24	21.71	22.75	39.95	45.31	61.33
Timber & Wood	(9)	32.56	31.81	30.81	27.09	28.51	30.43
Furniture & Fixtures	(4)	7.34	6.20	11.19	11.45	13.22	21.82
Pulp & Paper	(12)	23.30	22.67	25.03	10.05	11.32	13.87
Chemicals	(34)	12.05	13.17	13.13	9.42	11.29	12.17
Petroleum & Coal	(3)	3.60	1.95	6.00	4.63	4.55	7.06
Plastics	(15)	3.52	3.90	4.59	3.24	3.76	5.19
Rubber	(9)	23.25	27.27	33.03	17.71	20.00	24.91
Leather & Fur	(6)	28.23	31.59	33.77	38.17	43.82	50.51
Ceramics, Stones & Clay	(31)	12.58	14.17	19.11	8.23	8.91	13.44
Iron & Steel, Non-ferrous metals	(15)	24.83	26.33	27.24	20.48	19.04	18.21
Fabricated metals	(21)	6.29	7.02	10.37	5.96	6.74	10.66
General machinery	(36)	4.96	6.13	8.01	5.69	6.14	8.08
Electrical machinery	(37)	5.01	6.23	8.49	6.90	9.05	13.10
Transport. equipment	(7)	1.62	2.18	2.57	2.43	2.26	2.29
Precision Instruments	(18)	8.52	13.22	16.73	9.11	12.56	17.62
Miscellaneous	(19)	14.85	15.23	20.59	17.74	19.11	25.67

Reference: Import ratios of industries at the four-digit level



Notes.

1. The parentheses in the above table are the number of industries included in each industrial sector.
2. The reference figure shows the import ratios of four-digit classified industries in 1995, 1999 and 2003, which are arrayed in ascending order of import ratio.

Table 2: Ranking of Import Ratios by Industries

	1995		1999		2003	
Ranking	Industry	Import ratio	Industry	Import ratio	Industry	Import ratio
1	Wood chip mills	96.0%	Wood chip mills	96.8%	Small leather cases	95.9%
2	Ties	95.5%	Primary smelting and refining of aluminum	90.8%	Wood chip mills	95.1%
3	Organic fertilizers	88.0%	Small leather cases	89.1%	Primary smelting and refining of aluminum	91.1%
4	Small leather cases	81.0%	Organic fertilizers	89.1%	Hats, including hat bodies	87.7%
5	PULP	80.4%	Ties	88.6%	Organic fertilizers	87.4%
6	Primary smelting and refining of aluminum	76.5%	PULP	77.1%	Ties	87.2%
7	Hats, including hat bodies	73.3%	Wine, except "sake" (Japanese rice wine)	76.5%	Fur apparel and apparel accessories	86.2%
8	Fur apparel and apparel accessories	72.9%	Hats, including hat bodies	73.8%	Sweaters	86.1%
9	Wine, except "sake" (Japanese rice wine)	67.7%	Sweaters	69.8%	KNITTED GARMENTS AND SHIRTS	83.5%
10	Plastic footwear and its findings	65.4%	Frozen seafood products (unprocessed and packaged)	67.9%	PULP	80.5%
11	General sawing and planning mills	63.9%	SILK REELING PLANTS	67.6%	Knitted nightclothes	80.4%
12	Frozen seafood products (unprocessed and packaged)	63.6%	KNITTED GARMENTS AND SHIRTS	66.7%	Wine, except "sake" (Japanese rice wine)	78.7%
13	Textile nightclothes	62.5%	CUT STOCK AND FINDINGS FOR BOOTS AND SHOES	65.5%	Textile nightclothes	78.1%
14	Miscellaneous chemical fertilizers	61.5%	Knitted nightclothes	65.2%	SILK REELING PLANTS	77.3%
15	KNITTED GARMENTS AND SHIRTS	60.4%	Rubber footwear and its findings	65.0%	Plastic footwear and its findings	75.9%
16	Sweaters	60.4%	Miscellaneous chemical fertilizers	64.5%	Rubber footwear and its findings	75.4%
17	Elemental feeds	58.8%	Plastic footwear and its findings	64.0%	Knitted outer shirts	74.9%
18	Costume jewelry and costume accessories, except precious metals and jewelry	56.2%	General sawing and planning mills	63.6%	Ladies' and girl's outer garments	72.7%
19	Knitted nightclothes	56.1%	Textile nightclothes	60.4%	Frozen seafood products (unprocessed and packaged)	70.5%
20	Pottery ornaments	55.7%	Pottery ornaments	59.3%	CUT STOCK AND FINDINGS FOR BOOTS AND SHOES	68.8%
⋮	⋮		⋮		⋮	
330	Boilers	0.3%	Boilers	0.4%	Edible oils and fats	0.6%
331	Porcelain electrical supplies	0.3%	Motor vehicles bodies and trailers	0.3%	Clay roofing tile	0.5%
332	MECHANICAL LEATHER PRODUCTS, EXCEPT GLOVES AND MITTENS	0.3%	Porcelain electrical supplies	0.3%	Rubber hoses	0.5%
333	Edible oils and fats	0.3%	Gas and oil appliances	0.3%	Volumeters	0.5%
334	Rubber hoses	0.3%	Rubber hoses	0.3%	Gypsum products	0.4%
335	Foamed plastic products, rigid	0.2%	Clay roofing tile	0.2%	Motor vehicles bodies and trailers	0.4%
336	Explosives	0.2%	Aircraft engines	0.2%	School-use paper products	0.3%
337	Retreaded tires	0.2%	MECHANICAL LEATHER PRODUCTS, EXCEPT GLOVES AND MITTENS	0.2%	Malt liquors	0.2%
338	Volumeters	0.2%	Plastic sheets	0.2%	Corrugated board boxes	0.1%
339	Clay roofing tile	0.1%	Malt liquors	0.2%	Plastic sheets	0.1%
340	TIN CANS AND OTHER PLATED SHEET PRODUCTS	0.1%	Baked rice confections	0.1%	Industrial plastic products, except made by fabrication	0.1%
341	Plastic sheets	0.1%	Industrial plastic products, except made by fabrication	0.1%	MECHANICAL LEATHER PRODUCTS, EXCEPT GLOVES AND MITTENS	0.1%
342	Corrugated board boxes	0.1%	Miscellaneous abrasive products	0.1%	Baked rice confections	0.1%
343	Sake (Japanese rice wine)	0.0%	Corrugated board boxes	0.1%	TIN CANS AND OTHER PLATED SHEET PRODUCTS	0.1%
344	Industrial plastic products, except made by fabrication	0.0%	TIN CANS AND OTHER PLATED SHEET PRODUCTS	0.1%	Miscellaneous abrasive products	0.1%
345	Cast iron pipe	0.0%	Sake (Japanese rice wine)	0.0%	Biscuits, crackers and other dry bakery products	0.1%
346	Biscuits, crackers and other dry bakery products	0.0%	Corrugated board	0.0%	Corrugated board	0.1%
347	Corrugated board	0.0%	Cast iron pipe	0.0%	Sake (Japanese rice wine)	0.0%
348	Secondary forgings	0.0%	Secondary forgings	0.0%	Cast iron pipe	0.0%
349	Iron castings, except cast iron pipes and malleable iron castings	0.0%	Iron castings, except cast iron pipes and malleable iron castings	0.0%	Shoyu (soy sauce), and edible amino acids	0.0%
350	Shoyu (soy sauce), and edible amino acids	0.0%	Biscuits, crackers and other dry bakery products	0.0%	Lime products	0.0%
351	Bread	0.0%	Shoyu (soy sauce), and edible amino acids	0.0%	Secondary forgings	0.0%
352	Baked rice confections	0.0%	Bread	0.0%	Iron castings, except cast iron pipes and malleable iron castings	0.0%
353	Lime products	0.0%	Lime products	0.0%	Bread	0.0%
354	Rice cleaning and polishing	0.0%	Rice cleaning and polishing	0.0%	Rice cleaning and polishing	0.0%

Table 3 : Summary Statistics

Baseline sample

		Level			First-Difference		
		Mean	Median	St. dev.	Mean	Median	St. dev.
Regular employees	$\ln L_{it}$	7.57	7.38	1.48	-0.069	-0.067	0.211
Real wage per capita	$\ln w_{it}$	1.23	1.27	0.32	-0.004	-0.004	0.084
Nonlabor input price	$\ln r_{it}$	4.62	4.62	0.04	0.006	0.006	0.033
Import price	$\ln p^{m}_{it}$	4.66	4.66	0.09	0.014	0.031	0.076
Import ratio		0.45	0.40	0.22	0.019	0.019	0.052

Reference: Full sample

		Level			First-Difference		
		Mean	Median	St. dev.	Mean	Median	St. dev.
Regular employees	$\ln L_{it}$	8.57	8.59	1.46	-0.035	-0.029	0.157
Real wage per capita	$\ln w_{it}$	1.49	1.54	0.27	-0.004	-0.002	0.061
Nonlabor input price	$\ln r_{it}$	4.62	4.61	0.05	0.004	0.005	0.032
Import price	$\ln p^{m}_{it}$	4.66	4.67	0.11	0.010	0.021	0.081
Import ratio		0.15	0.07	0.20	0.007	0.002	0.032

Notes.

1. The baseline sample consists of "import-competing industries" among total 354 manufacturing, whose labor shares and import ratios are over 0.4 and 0.2, respectively.
2. While the levels are from 1994 to 2003, the differences are from 1995 to 2003. They are based on the logarithmic transformed values.

Table 4 : Econometric Estimate of Labor Demand Equation

(1) Baseline Estimation Results

Independent variables	Baseline sample (1)		Baseline sample (2)		Non-baseline sample (3)		Non-baseline sample (4)	
	Dependent variable : $\ln L_{it}$							
$\ln L_{it-1}$	0.440	(0.179)	0.454	(0.174)	0.341	(0.151)	0.343	(0.151)
$\ln L_{it-2}$	0.131	(0.094)	0.139	(0.095)	0.138	(0.035)	0.138	(0.035)
$\ln w_{it}$	-0.573	(0.318)	-0.574	(0.319)	-0.296	(0.356)	-0.319	(0.349)
$\ln r_{it}$	0.522	(0.567)			0.155	(0.177)		
Effects of import competition								
$\ln p^m_{it}$	0.447	(0.262)	0.605	(0.307)	-0.002	(0.077)	0.037	(0.074)
m_2	0.50	(0.62)	0.52	(0.60)	-0.35	(0.72)	-0.34	(0.74)
Sargan test	50.50	(0.91)	52.97	(0.86)	66.32	(0.43)	64.30	(0.50)
S.E.^{2}	0.07		0.07		0.03		0.03	
No. of industries	57		57		297		297	
No. of observations	342		342		1,782		1,782	

Notes.
1. Column (1) and (2) are the estimation results with our baseline samples. Column (3) and (4) present the results with non-baseline sample, which is obtained by removing the baseline sample from the full sample consisting of total 354 manufacturing industries.
2. Estimation is by the Generalized Method of Moments, i.e., GMM. Both constant term and time dummies are included in all specifications.
3. The parameters are all one-step GMM estimates. The standard errors of one-step estimates are reported in parentheses.
4. The m_2 is a test statistic of the second-order serial correlation in two-step GMM estimation. The p-values are in parentheses under the null of no second-order serial correlation in the first-difference residuals. The Sargan is a test statistic of over-identifying restrictions in two-step GMM estimation. The p-values in parentheses represent instrument validity under the null of satisfying over-identifying restrictions.
5. After first-differencing, both $\ln L_{i\,t-1}$ and $\ln w_{i\,t}$ are treated to be endogenous. Additional instruments include $\ln L_{i\,(t-2,\,t-3...)}$, $\ln w_{i\,(t-2,\,t-3...)}$, and $\Delta\ln CP_{j\,(t-2,\,t-3)}$, where CP_j denotes corporate price of industry j.

Table 4 : continued

(2) Subsample Estimation Results

Subsample Estimation:
The labor demand equation is estimated with subsample, i.e., industry data selected by lowering the criterion value of labor share and import ratio from the baseline value, i.e., labor share is 0.4 and import ratio is 0.2, respectively, by 0.1 point.

Estimated Import Price Elasticities

		Labor Share				
		0.0	0.1	0.2	0.3	0.4
Import Ratio	0.0	0.078 (0.077) 354	0.077 (0.077) 353	0.089 (0.079) 333	0.111 (0.094) 281	0.193 (0.120) 185
	0.1	0.111 (0.119) 139	0.111 (0.119) 139	0.126 (0.123) 135	0.112 (0.133) 120	0.322 (0.189) * 86
	0.2	0.312 (0.193) 84	0.312 (0.193) 84	0.322 (0.193) * 83	0.388 (0.190) ** 76	0.605 (0.307) ** 57

Baseline sample

Notes.
1. The upper-left stand of each cell in the table denote parameter estimate with subsample estimation, i.e., import price elasticity, while standard errors are in parentheses in upper-right stand. Both ** and * indicate the significance levels of 5 and 10 %, respectively. The lower stand represents the number of industries included in the subsample.
2. All results are from the estimates of labor demand equation specified without variable of nonlabor input price. See notes in Table 4(1) for the estimation method and the set of instruments.

Table 4 : continued

Reference: Subsample Estimation Results (in details)

Sample selection																
	Labor share	0.0	0.1	0.2	0.3	0.4	0.0	0.1	0.2	0.3	0.4	0.0	0.1	0.2	0.3	0.4
	Import ratio	0.0	0.0	0.0	0.0	0.0	0.1	0.1	0.1	0.1	0.1	0.2	0.2	0.2	0.2	0.2
Independent variables		Dependent variable : $\ln L_{it}$														
$\ln L_{it-1}$		0.582	0.582	0.568	0.577	0.621	0.649	0.649	0.653	0.633	0.486	0.624	0.624	0.621	0.595	0.454
		(0.126)	(0.126)	(0.126)	(0.129)	(0.138)	(0.143)	(0.143)	(0.147)	(0.161)	(0.178)	(0.149)	(0.149)	(0.148)	(0.154)	(0.174)
$\ln L_{it-2}$		0.185	0.185	0.185	0.183	0.164	0.182	0.182	0.178	0.172	0.165	0.172	0.172	0.172	0.160	0.139
		(0.045)	(0.045)	(0.046)	(0.051)	(0.071)	(0.077)	(0.077)	(0.078)	(0.079)	(0.077)	(0.089)	(0.089)	(0.089)	(0.092)	(0.095)
$\ln w_{it}$		-1.113	-1.111	-1.129	-1.215	-1.055	-0.746	-0.746	-0.742	-0.826	-0.640	-0.741	-0.741	-0.716	-0.736	-0.574
		(0.368)	(0.368)	(0.371)	(0.368)	(0.332)	(0.307)	(0.307)	(0.310)	(0.318)	(0.266)	(0.356)	(0.356)	(0.364)	(0.371)	(0.319)
Effect of import competition																
$\ln p^m_{it}$		0.078	0.077	0.089	0.111	0.193	0.111	0.111	0.126	0.112	0.322	0.312	0.312	0.322	0.388	0.605
		(0.077)	(0.077)	(0.079)	(0.094)	(0.120)	(0.119)	(0.119)	(0.123)	(0.133)	(0.189)	(0.193)	(0.193)	(0.193)	(0.190)	(0.307)
m_2		0.45	0.45	0.53	0.40	0.56	0.37	0.37	0.39	0.47	0.48	0.38	0.38	0.38	0.43	0.52
		(0.65)	(0.65)	(0.60)	(0.69)	(0.58)	(0.72)	(0.72)	(0.70)	(0.64)	(0.63)	(0.71)	(0.71)	(0.71)	(0.67)	(0.60)
Sargan test		67.81	67.88	70.10	62.44	66.57	76.06	76.06	74.29	74.07	77.96	67.38	67.38	66.63	69.01	52.97
		(0.38)	(0.38)	(0.31)	(0.57)	(0.42)	(0.16)	(0.16)	(0.20)	(0.21)	(0.13)	(0.40)	(0.40)	(0.42)	(0.34)	(0.86)
S.E.[2]		0.05	0.05	0.05	0.05	0.05	0.06	0.06	0.06	0.06	0.06	0.07	0.07	0.07	0.07	0.07
No. of industries		354	353	333	281	185	139	139	135	120	86	84	84	83	76	57
No. of observation		2,124	2,118	1,998	1,686	1,110	834	834	810	720	516	504	504	498	456	342

Note.
See notes in Table 4(1) for the estimation method and the set of instruments.

Table 5 : Breakdown of Import-Competing Industries

(1) Shares of Import-Competing Industries

The "Import-Competing Industries" are the industries with which the effects of import competition are found to be statistically significant.

Industry group A: Labor share > 0.4, Import ratio > 0.2 (57 Industris)
Industry group B: Labor share > 0.3, Import ratio > 0.2 (76 Industris)

Sector	Import-Competing Industries: Industry Group A	Import-Competing Industries: Industry Group B	Total Industries
Food	0.05	0.11	0.11
Textile	**0.37**	**0.30**	**0.11**
Material	0.14	0.17	0.22
petrochemistry	0.18	0.14	0.19
Machinery	0.07	0.11	0.28
Miscellaneous	**0.19**	**0.17**	**0.09**
Sum	1.00	1.00	1.00

Reference : Breakdown of Manufacturing Sector

Sector	Breakdown of Industries
Food	Foods, Beverage, Tobacco & Feed
Textile	Textile, Apparel and textile products
Material	Pulp & paper, Ceramic, stone & clay, Iron & steel, Nonferrous metals, Metal products
Petrochemistry	Chemical, Peteroleum & coal, Rubber, Plastic, Leather & Fur products
Machinery	General, electric, transportation and precision machinery
Miscellaneous	Timber & Wooden products, Furniture & Fixture

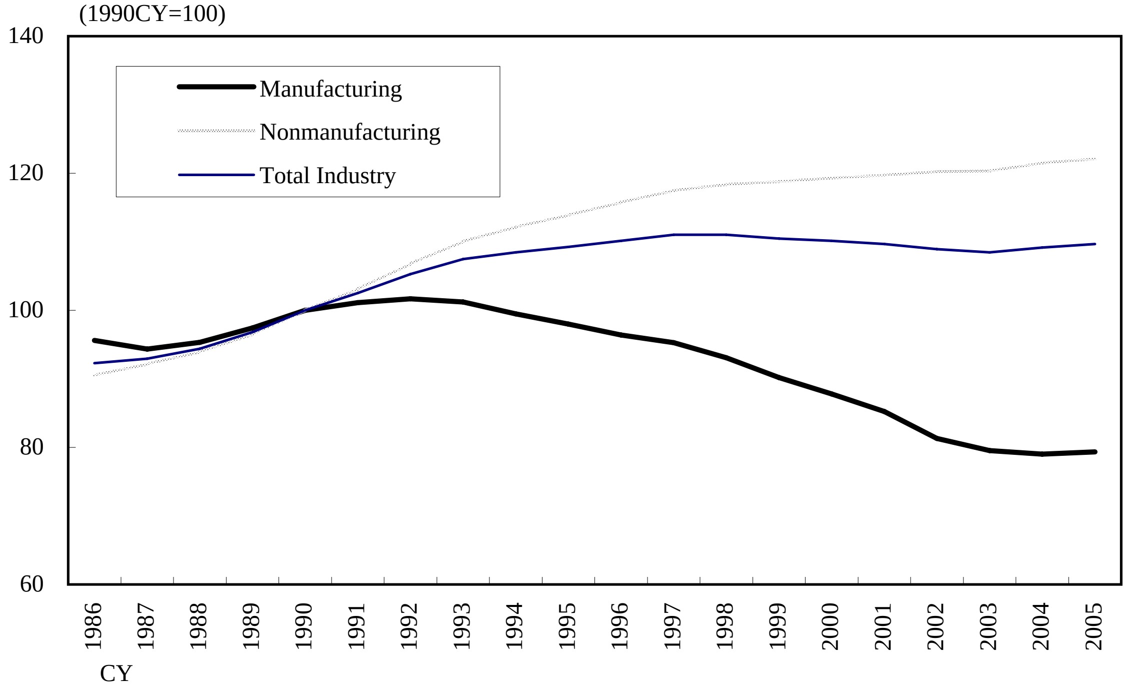
Table 5 : continued

(2) Breakdown of Import-Competing Industries

	Industry Group A (57 industries)	Industry Group B (76 industries)
1	Animal oils and fats	Meat products
2	Elemental feeds	Canned seafood and seaweed
3	Organic fertilizers	Frozen seafood products (unprocessed and packaged)
4	SILK REELING PLANTS	Canned and preserved fruit and vegetable products, except vegetables pickled or in brine
5	Bulky yarns	Animal oils and fats
6	Machine dyed and finished cotton, spun rayon, hard and bast fiber fabrics	Wine, except "sake" (Japanese rice wine)
7	Miscellaneous netting	Elemental feeds
8	Embroidery lace	Organic fertilizers
9	Men's and boy's outer garments	SILK REELING PLANTS
10	Ladies' and girl's outer garments	TWISTING AND BULKY YARNS
11	Shirts	Bulky yarns
12	Business, work, sanitary and sport clothing	Machine dyed and finished cotton, spun rayon, hard and bast fiber fabrics
13	Knitted garments, except outer shirts and sweater	Miscellaneous netting
14	Knitted outer shirts	Embroidery lace
15	Sweaters	Men's and boy's outer garments
16	Miscellaneous knitted garments and shirts	Ladies' and girl's outer garments
17	Textile underwear	Shirts
18	Knitted underwear	Business, work, sanitary and sport clothing
19	Textile nightclothes	Knitted garments, except outer shirts and sweater
20	Knitted nightclothes	Knitted outer shirts
21	Foundation garments	Sweaters
22	Ties	Miscellaneous knitted garments and shirts
23	Hats, including hat bodies	Textile underwear
24	Fur apparel and apparel accessories	Knitted underwear
25	General sawing and planning mills	Textile nightclothes
26	Veneer wood	Knitted nightclothes
27	Wood chip mills	Foundation garments
28	Plywood	Ties
29	Mirror frames and picture frames	Hats, including hat bodies
30	Pulp	Fur apparel and apparel accessories
31	Miscellaneous chemical fertilizers	Textile bags
32	Fatty acids, hydrogenated oils and glycerin	General sawing and planning mills
33	Perfumes and fragrances	Veneer wood
34	Natural resin and wood chemical products	Wood chip mills
35	Tires and tubes for bicycles	Plywood
36	Rubber footwear and its findings	Mirror frames and picture frames
37	Plastic footwear and its findings	Pulp
38	Leather tanning and finishing	Fiberboard
39	Cut stock and findings for boots and shoes	Miscellaneous chemical fertilizers
40	Leather footwear	Fatty acids, hydrogenated oils and glycerin
41	Table and kitchen glassware	Perfumes and fragrances
42	Pottery ornaments	Natural resin and wood chemical products
43	Cut-stones and stone ware products	Tires and tubes for bicycles
44	Artificial jewels	Rubber footwear and its findings
45	Nuclear fuel	Plastic footwear and its findings
46	Edge tools, artisans' tools and hand tools, except files, saws and knives for kitchen use	Leather tanning and finishing
47	Fabricated metal products, n.e.c.	Cut stock and findings for boots and shoes
48	Miscellaneous industrial electrical apparatus, including those for vehicles and vessels	Leather footwear
49	Motion picture equipment and their parts	Small leather cases
50	Ophthalmic goods, including frames	Table and kitchen glassware
51	Watches, clocks and parts, except watchcases	Pottery ornaments
52	Guitars	Cut-stones and stone ware products
53	Dolls	Artificial jewels
54	Children's vehicles	Primary smelting and refining of aluminum
55	Costume jewelry and costume accessories, except precious metals and jewelry	Miscellaneous primary smelting and refining of non-ferrous metals
56	Thermos bottles	Secondary smelting and refining of aluminum, including aluminum alloys
57	Models and patterns, except of paper	Nuclear fuel
58		Non-ferrous metal products, n.e.c.
59		Edge tools, artisans' tools and hand tools, except files, saws and knives for kitchen use
60		Fabricated metal products, n.e.c.
61		Steam engines, turbines and water wheels, except marine engines
62		Miscellaneous industrial electrical apparatus, including those for vehicles and vessels
63		ELECTRIC MEASURING INSTRUMENTS
64		Medical instruments and apparatus
65		Medical supplies
66		Motion picture equipment and their parts
67		Ophthalmic goods, including frames
68		Watches, clocks and parts, except watchcases
69		Jewelry products of precious metal and precious stone
70		Guitars
71		Dolls
72		Children's vehicles
73		Sporting and athletic goods
74		Costume jewelry and costume accessories, except precious metals and jewelry
75		Thermos bottles
76		Models and patterns, except of paper

Figure 1: Japan's Regular Workers and Import Value

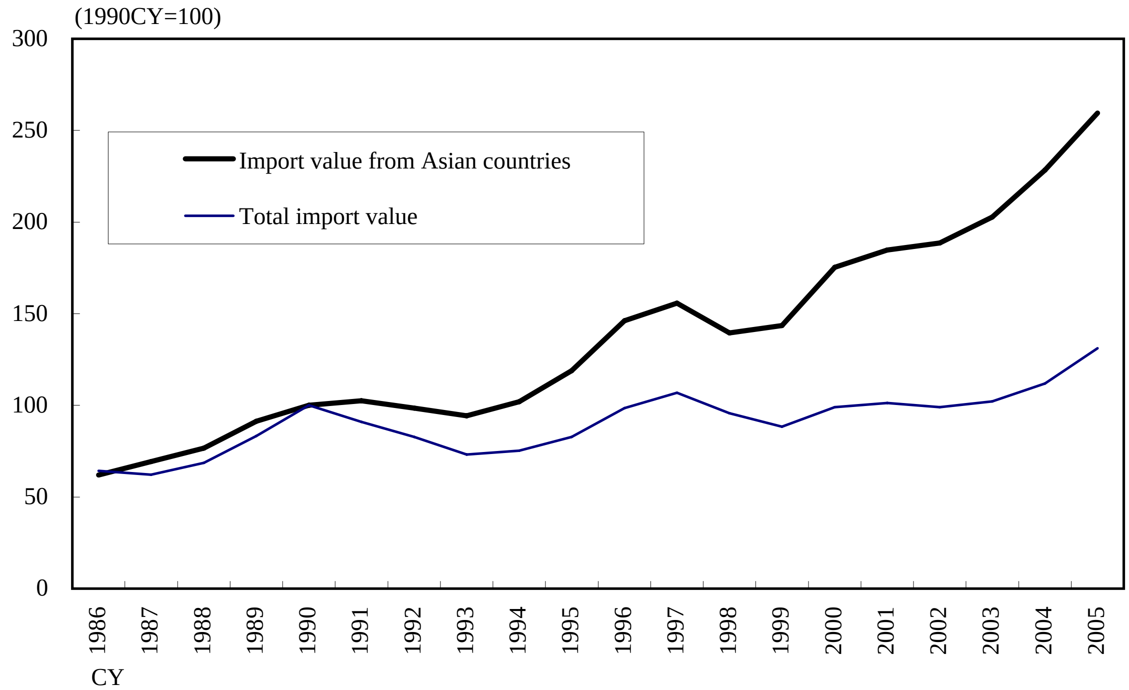
(1) The Number of Japan's Regular Workers



Notes.

1. The number of Japan's regular workers is from "Monthly Labour Survey," compiled by the Ministry of Health, Labour and Welfare. The survey population is establishments with 30 workers or more through 1990 and establishments with 5 workers or more from 1991.
2. The number of regular workers in nonmanufacturing sector is obtained by removing the number of regular workers in manufacturing from those in total industry.

(2) Import Value

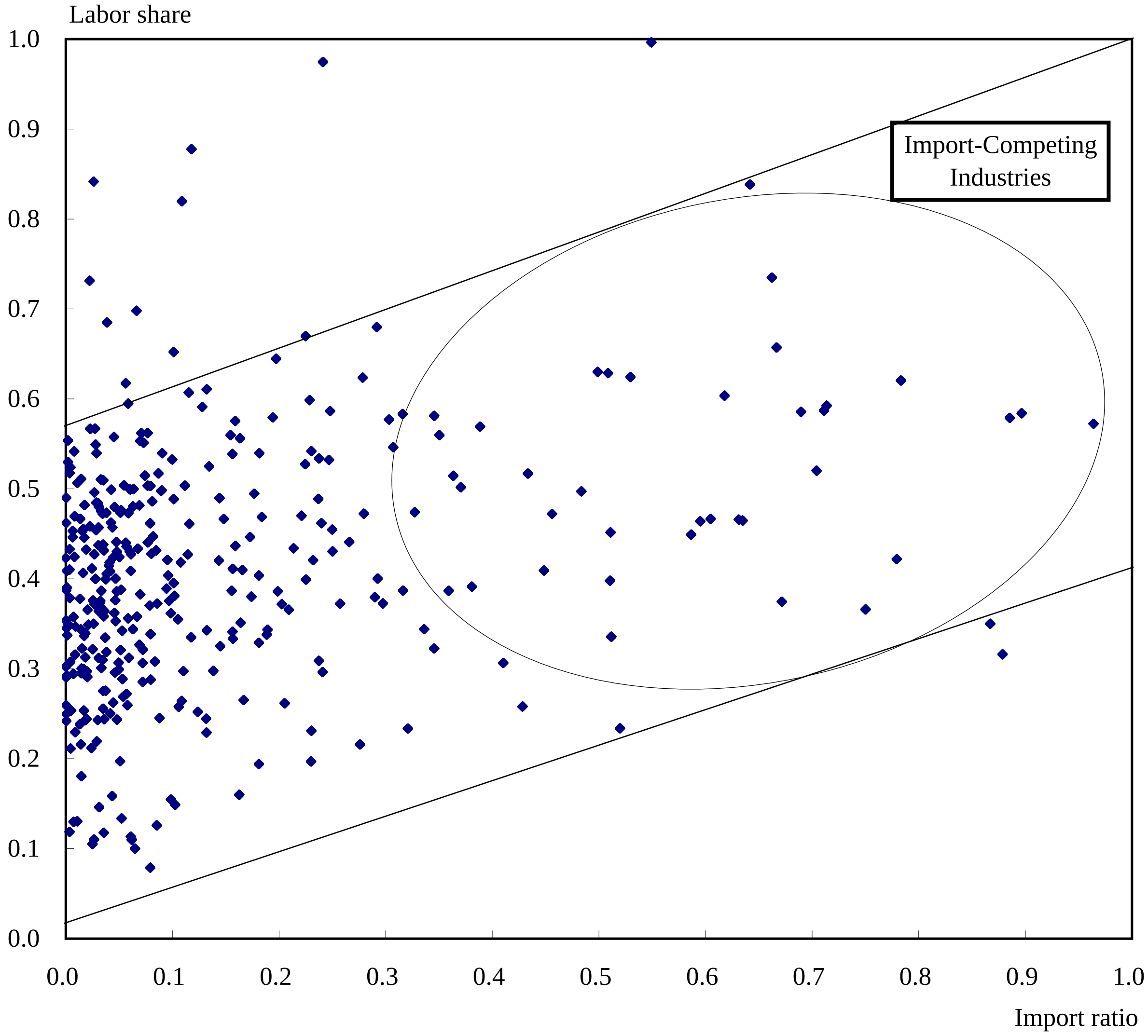


Source.

Japan Tariff Association "Summary Report on Trade of Japan"

Figure 2 : Selection of Import-Competing Industries

(1) Scatter Diagram of Labor Shares and Import Ratios on Total Manufacturing Industries



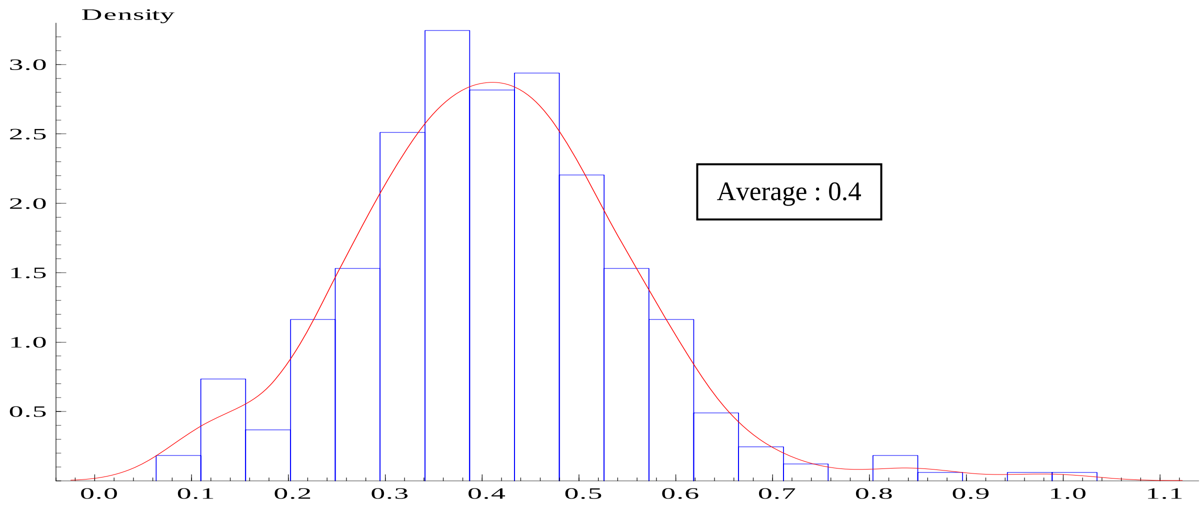
Notes.

1. The above scatter diagram shows the relationships between labor shares and import ratios (averages from 1994 to 2003) of total 354 manufacturing industries at the four-digit level.
2. The labor share is calculated as the ratio of total cash earning to value added.

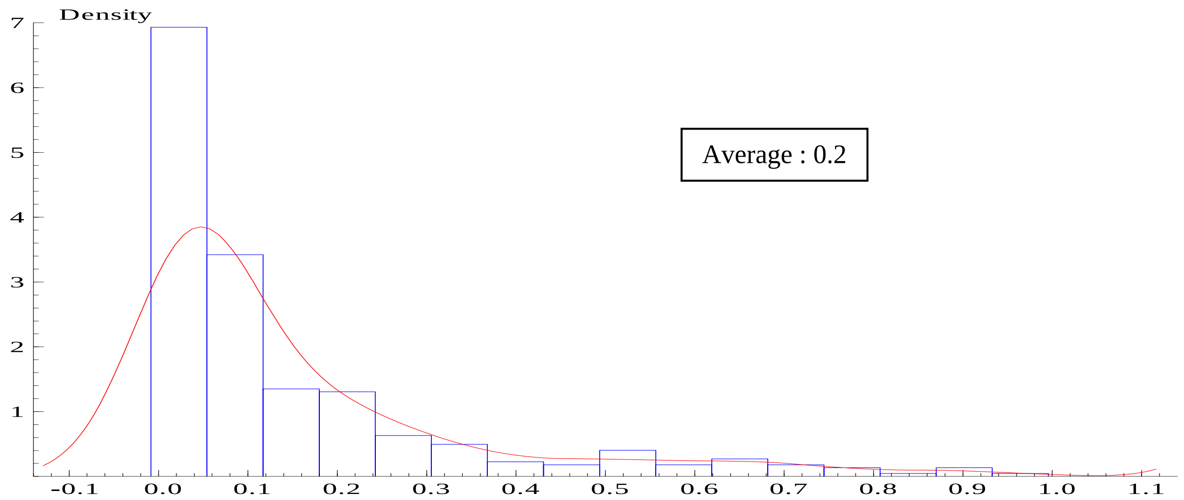
Figure 2 : continued

(2) Histogram of Labor Shares and Import Ratios

Labor shares



Import ratios



Investigating the quantitative impacts of import competition by selecting the industries with high labor shares and import ratios.

↓

Selecting the industries whose labor shares and import ratios exceed the averages of total industries, i.e., 0.4 and 0.2, respectively, as baseline import-competing industries.