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Japan out of the Lost Decade: Divine Wind or Firms' Effort?

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Abstract

A surge of exports in the 2000s helped Japan exit the severe decade-long stagnation known as the lost decade. Using panel data of Japanese exporting firms, we examine the sources of the export surge during this period. One view argues that the so-called "divine wind" or exogenous external demand boosted Japanese exports. The other view emphasizes the role of supply factors such as productivity gains, materialized after long-fought restructuring efforts during the lost decade. Estimating the firm-level export function allows us to assess the relative importance of these demand and supply factors. Evidence shows that firms' efforts were more important than the divine wind.

JEL Classification Numbers: E44, F14, O30

Keywords: Lost Decade, Export, Total Factor Productivity, Price-Cost Margin

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I. Introduction

Ample of evidence shows that a surge of exports in the 2000s helped Japan get out of the so-called lost decade of the 1990s. The Japanese GDP growth rate (blue bars in Figure 1) averaged 1.8 percent during 2002 to 2007 before it turned negative in the 2008-09 global financial crisis. Almost two thirds of this growth were due to growth in exports (red bars in Figure 1). This is a distinct contrast from the period between 1992 and 2001, where the GDP growth rate averaged 0.9 percent and only one third of this growth was due to growth in exports.

The question is what has led to this export growth in the 2000s. One view is that the "divine wind" or a surge of exogenous external demand, especially from China and other emerging markets in Asia, was the source of export growth. Indeed, Japanese exports to China and Asian NIEs (Hong Kong SAR, Korea, Singapore and Taiwan Province of China) accelerated from the early 2000s (Figure 2). The average export growth rate to China during 2001 to 2007 almost doubled from that during 1991 to 2001 (Table 1). Similarly, Japanese exports to Asian NIEs increased sharply from 1.7 percent during 1991 to 2001 to 10 percent during 2001 to 2007.[1] Such evidence alone however cannot verify whether the export growth was indeed driven by exogenous forces.

The other competing argument is that the productivity gain of exporting firms has resulted in a surge of exports. Following the seminal work of Bernard and Jensen (1995), a positive relationship between productivity and exports is well documented for many countries and Japan is no exception.[2] A rapid growth in productivity of Japanese firms in the 2000s is also well evidenced, for example Kwon et al. (2008). These findings together could imply that the productivity gain of Japanese firms in the early 2000s had led to the export surge to China and Asian NIEs.

The main objective of this paper is to evaluate quantitatively the relative importance of sources of Japanese export growth. The rapid growth observed in China and other emerging markets in Asia and their demand for Japanese products is an exogenous demand factor for Japanese exports, while productivity gain is a supply factor. Which factor had a larger role to play is an empirical question. We therefore turn to panel data of Japanese exporting firms for an answer. In particular, we focus on listed firms with registered primary exporting goods in the three leading exporting industries: general machinery, electrical machinery, and transportation equipment.[3] The sample period is between 1995 and 2007; which includes both the stagnation phase in the 1990s and the recovery phase in the 2000s.

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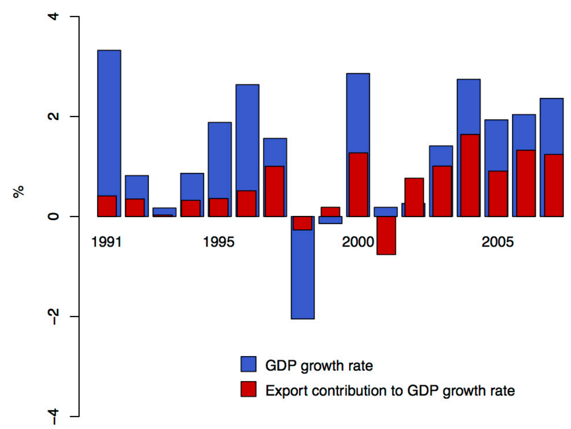
[1] There is little difference in the GDP growth rate between the two periods for both regions: the average GDP growth rate of China and Asian NIEs is 10.4 percent and 5.6 percent during 1991 to 2001, and 11.2 percent and 5.2 percent during 2002 to 2007, respectively.

[2] For example, positive relationship between productivity and export has been found in the United States by Bernard and Jensen (1995, 1999, 2004a, 2004b) and Bernard et al. (2007), in Canada by Baldwin and Gu (2003), in European countries by Bernard and Wagner (2001) and Mayer and Ottaviano (2007), in Colombia, Mexico and Morocco by Clerides et al. (1998), in Asian countries by Aw et al. (2000) and Hallward-Driemeier et al. (2002) and in Japan by Kimura and Kiyota (2006), Tomiura (2007), Wakasugi et al. (2008), Todo (2009) and Yashiro and Hirano (2010).

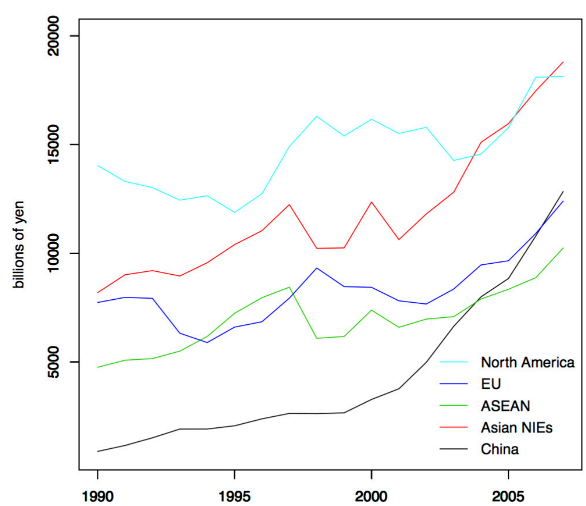
[3] The aggregate export share by these three industries amounts to 64.8 percent (2007) to 71.5 percent (1994).

Figure 1: Export Contribution to GDP Growth Rate



Data Source: *Annual Report on National Accounts*, Cabinet Office.

Figure 2: Japanese Export by Destination



Data Source: *Trade Statistics of Japan*, Ministry of Finance

Table 1: Average annual growth rate of export by eestination

	(1) North America	(2) EU	(3) ASEAN	(4) Asian NIES	(5) China
1991-2001	1.6	-0.2	2.6	1.7	12.5
2001-2007	2.6	8.0	7.6	10.0	22.7

Data Source: *Trade Statistics of Japan*, Ministry of Finance

We find that productivity gain is much more important than exogenous income growth of trading partners in explaining the surge of exports in the 2000s. We first derive and estimate two equations: (i) the optimal export function, which depends not only on exogenous income growth of trading partners, but also on price-cost margins (or profitability) of exporters, and (ii) the price-cost margin equation, which depends on total factor productivity (TFP) as well as factors affecting the cost of production. Using estimates of parameters of these equations, we then measure the share of variations in exports explained by those in determinants of exports. We find that TFP explains close to 50 percent of total variations in exports while income growth of trading partners under 20 percent. This finding implies that firms' strenuous efforts in restructuring during the 1990s played an important role in generating a surge of exports in the 2000s and thus the steady growth out of the lost decade.

The remainder of the paper is organized as follows. In Section 2 we characterize the exporting behavior of a firm in partial equilibrium model in line with the recent trade model á la Melitz (2003) that features firm heterogeneity. We describe our data characteristics in Section 3. Empirical results of the export and price-cost margin equations are presented in Section 4. Section 5 evaluates quantitatively the contribution of demand and supply factors to exports. The last section concludes.

II. Model

A. Exporting Behavior

We construct a market equilibrium model of firms that sell their products in both domestic and overseas markets. Our model is in line with the recent trade theory developed by Melitz (2003), Melitz and Ottaviano (2008) and Bernard et al. (2003) that stresses firm heterogeneity. Consider a profit-maximizing firm that sells its product in both domestic and overseas markets. The firm faces a downward-sloping demand curve in domestic and overseas market, respectively. We assume that there are N firms in the market. Downward-sloping demand curve in overseas market is given by

$$Q_E = E\left(\frac{p_E}{ep_W}\right)^{-\eta}, \tag{1}$$

where

$$Q_E : \text{demand for exports,}$$
$$p_E : \text{export price on a yen basis,}$$
$$p_W : \text{world price on a dollar basis,}$$
$$e : \text{exchange rate (yen per dollar),}$$
$$\eta : \text{price elasticity of overseas demand, and}$$
$$E : \text{factors that shift export demand.}$$

The inverse demand curve is expressed as

$$p_E = ep_W B Q_E^{-\frac{1}{\eta}}, \tag{2}$$

where

$$B = E^{\frac{1}{\eta}}.$$

Similarly, downward-sloping demand curve in domestic market and the inverse domestic demand curve are given by eqs. (3) and (4), respectively.

$$Q_D = H p_D^{-\vartheta}, \tag{3}$$

where

$$Q_D : \text{domestic demand,}$$
$$p_D : \text{domestic price,}$$
$$\vartheta : \text{price elasticity of domestic demand, and}$$
$$H : \text{factors that shift domestic demand.}$$

$$p_D = J Q_D^{-\frac{1}{\vartheta}}, \tag{4}$$

where

$$J = H^{\frac{1}{\vartheta}}.$$

The i-th firm maximizes its profit π_i, defined by (5), with respect to overseas sales (Q_{iE}) and domestic sales (Q_{iD}):

$$\pi_i = p_E Q_{iE} + p_D Q_{iD} - C_i(T_i, r_i, w_i, p_{Mi})(Q_{iE} + Q_{iD}) - \phi(A_i) Q_{iE}, \tag{5}$$

where

$$p_E = ep_W B \left(\sum_{i=1}^{N} Q_{iE} \right)^{-\frac{1}{\eta}},$$

$$p_D = J \left(\sum_{i=1}^{N} Q_{iD} \right)^{-\frac{1}{\vartheta}},$$

$$C_i(T_i, r_i, w_i, p_{M,i}) : \text{unit cost function with}$$

$$\frac{\partial C_i}{\partial T_i} < 0, \frac{\partial C_i}{\partial r_i} > 0, \frac{\partial C_i}{\partial w_i} > 0, \frac{\partial C_i}{\partial p_{M,i}} > 0,$$

$$T_i : \text{total factor productivity,}$$

$$r_i : \text{rental cost of capital,}$$

$$w_i : \text{wage rate,}$$

$$p_{M,i} : \text{material price,}$$

$$\phi(A_i) : \text{unit trading cost with } \phi'(A_i) < 0, \text{ and}$$

$$A_i : \text{total asset.}$$

It is assumed that production technology is linearly homogeneous so that the unit cost function does not depend on the level of output. The trading cost includes expenses on market research of overseas market, tariff, and transportation costs. We assume that the unit trading cost is a decreasing function of firm size, measured by total assets.[4]

The first order condition is given by (6):[5] for all $i = 1, \ldots, N$,

$$Bep_W \left(-\frac{1}{\eta} \right) \left(\sum_{i=1}^{N} Q_{iE} \right)^{-\frac{1}{\eta}-1} Q_{iE} + p_E - C_i(T_i, r_i, w_i, p_{M,i}) - \phi(A_i) = 0, \text{ and}$$

$$p_D \left(-\frac{1}{\vartheta} \right) \left(\sum_{i=1}^{N} Q_{iD} \right)^{-\frac{1}{\vartheta}-1} Q_{iD} + p_D - C_i(T_i, r_i, w_i, p_{M,i}) = 0. \tag{6}$$

Using the total export demand and domestic demand, eq.(6) can be re-written as follows.

$$p_E \left(-\frac{1}{\eta} \right) \frac{Q_{iE}}{Q_E} + p_E = C_i(T_i, r_i, w_i, p_{M,i}) + \phi(A_i), \text{ and}$$

$$p_D \left(-\frac{1}{\vartheta} \right) \frac{Q_{iD}}{Q_D} + p_D = C_i(T_i, r_i, w_i, p_{M,i}). \tag{7}$$

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[4] Forslid and Okubo (2011) find that the unit trading cost is a decreasing function of firm size due to scale economy.

[5] When unit production cost plus unit trading cost exceeds export price or $p_E < C_i(T_i, r_i, w_i, p_{M,i}) + \phi(A_i)$, the firm will not enter the export market. It is more likely that this inequality is held for a firm with lower TFP and thus higher unit production cost. This might explain positive correlation of productivity and export found in many empirical studies. Here we assume that $p_E \geq C_i(T_i, r_i, w_i, p_{M,i}) + \phi(A_i)$ for N incumbent firms in the market.

Thus the i-th firm's share in total export and domestic sales is given by eq.(8).

$$\frac{Q_{iE}}{Q_E} = \eta\left(1 - \frac{C_i(T_i, r_i, w_i, p_{M,i})}{p_E} - \frac{\phi(A_i)}{p_E}\right), \text{ and}$$
$$\frac{Q_{iD}}{Q_D} = \vartheta\left(1 - \frac{C_i(T_i, r_i, w_i, p_{M,i})}{p_D}\right). \tag{8}$$

The i-th firm's share in total export depends upon the price-cost margin $p_E/C_i(T_i, r_i, w_i, p_{M,i})$ and real unit trading cost. The firm with higher price-cost margin may attain higher share of export. The price-cost margin is an increasing function of TFP and a decreasing function of wage rate, rental price of capital and material price, so that the firm's export share increases when the firm raises its TFP and faces lower input prices. The firm may also increase its export share by lowering real unit trading cost. A larger firm may increase its export share since it faces lower trading cost due to scale economy. From eq. (8) the export function is written as

$$Q_{iE} = f\left(Q_E, \frac{C_i(T_i, r_i, w_i, p_{M,i})}{p_E}, \frac{\phi(A_i)}{p_E}\right). \tag{9}$$

Note that Q_E is a function of relative prices p_E/ep_W and factors that shift the export demand function E, as is given by (1). An important ingredient of shift parameter is world income. To sum up, the export function is expressed as

$$Q_{iE} = f\left(y_E, \frac{p_E}{ep_W}, \frac{C_i(T_i, r_i, w_i, p_{M,i})}{p_E}, A_i\right), \tag{10}$$

where y_E : world income.

B. Equilibrium Export Price

Aggregating the first order condition of export given by eq.(7) across firms, we obtain the following equation:

$$p_E\left(-\frac{1}{\eta}\right)\frac{\sum_{i=1}^{N} Q_{iE}}{Q_E} + p_E N = \sum_{i=1}^{N} C_i(T_i, r_i, w_i, p_{M,i}) + \sum_{i=1}^{N}\phi(A_i). \tag{11}$$

Using the market clearing condition $\sum_{i=1}^{N} Q_{iE} = Q_E$, we can solve eq.(11) in terms of p_E as

$$p_E = \frac{1}{1 - \frac{1}{\eta N}}\left(\frac{\sum_{i=1}^{N} C_i(T_i, r_i, w_i, p_{M,i})}{N} + \frac{\sum_{i=1}^{N}\phi(A_i)}{N}\right). \tag{12}$$

Yen-denominated export price is therefore described as a function of the average unit cost and unit-trading cost multiplied by the mark-up ratio. A rise in TFP will lower Japanese export price relative to world price and hence increases overseas demand for Japanese exports.

C. Role of External Finance to Exporters

It is implicitly assumed that exporters do not face liquidity constraints in deriving the optimal export function above. However recent empirical studies find that exporters might be liquidity-constrained. Amiti and Weinstein (2011) demonstrate that trade finance provided by the financial institutions plays an important role in exporting behavior of Japanese listed firms. Using matched bank-firm data, they demonstrate that banks transmitted financial shocks to exporters in the financial crises during the 1990s. In other words, bank health was improved by wiping out non-performing loans, which enabled the financial institutions to provide trade finance to exporters and contributed to export increase.[6]

The export function might be extended by including the bank health variable. We use as a proxy of bank health the lending attitude diffusion index (DI) of financial institutions that measures easiness of providing external finance to exporters. Lending attitude DI is defined as the difference between the proportion of the firms feeling the lending attitude to be accommodative and that of the firms feeling the lending attitude to be severe. The larger the lending attitude DI, the easier it is for exporters to obtain external finance from the banking sector. The extended export function is written as

$$Q_{iE} = f\left(y_E, \frac{p_E}{ep_W}, \frac{C_i(T_i, r_i, w_i, p_{M,i})}{p_E}, A_i, LEND_i\right), \tag{13}$$

where

$LEND_i$: lending attitude DI of financial institutions.

III. Data Description

Three key variables in this study are: total factor productivity, price-cost margins, and real exports. This section describes, for each variable in turn, (i) how these variables are constructed, and (ii) the main features of these variables during the sample period, 1995-2007.[7]

The primary data source used in this study is the set of unconsolidated financial statements of firms listed in the First Section of the Tokyo Stock Exchange. The database

[6] A number of researchers have examined the role of trade finance or external finance in exporting behavior. For example, see Kletzer and Bardhan (1987), Ronci (2005), Muûls (2008), Bricogne et al. (2009), Iacovone and Zavacka (2009), Feenstra et al. (2010), Haddad et al. (2010), Levchenko et al. (2010), Manova et al. (2011), and Chor and Manova (2010).

[7] We stopped the sample period at 2007 to retain the richness of the panel dimension of firm-level data. For this study, the use of unconsolidated (as opposed to consolidated) financial statements of firms is crucial because only the former provides details on cost structure and capital stock as well as export values. Since 2000, however, the Japanese Accounting Standard has placed a greater importance on simplified consolidated (rather than unconsolidated) account, and as a result, the number of firms reporting every item in unconsolidated account has decreased over time. In particular, the number of firms reporting export values dramatically decreases from 162 in 2007 to 35 in 2008. To examine whether the determinants of export growth in the post-Lehman period remained productivity-dominant or not would have been an interesting extension, provided that the data constraint was not an issue. This analysis however would have been beyond the scope of this paper and of the dataset chosen for this study.

is provided in electronic basis by Nikken Inc., known as NEEDS database. Our analysis focuses on the machinery-manufacturing firms since these firms played a vital role in the recovery process from the lost decade by exporting activities.

The first variable, total factor productivity for firm i at time t, $T_{i,t}$, is constructed as follows:

$$\log(T)_{i,t} = \left(\log X_{i,t} - \overline{\log X_t}\right) - \sum_j \frac{1}{2}\left(S_{j,i,t} + \overline{S_{j,t}}\right)\left(\log j_{i,t} - \overline{\log j_t}\right) \text{ for } t = 0, \text{ and} \tag{14}$$

$$\begin{aligned} \log(T)_{i,t} &= \left(\log X_{i,t} - \overline{\log X_t}\right) \\ &- \sum_j \frac{1}{2}\left(S_{j,i,t} + \overline{S_{j,t}}\right)\left(\log j_{i,t} - \overline{\log j_t}\right) + \sum_{s=1}^{t}\left(\overline{\log X_s} - \overline{\log X_{s-1}}\right) \\ &- \sum_{s=1}^{t}\sum_j \frac{1}{2}\left(\overline{S_{j,s}} + \overline{S_{j,s-1}}\right)\left(\overline{\log j_{i,t}} - \overline{\log j_t}\right) \text{ for } t > 0, \end{aligned} \tag{15}$$

where the upper bars indicate the industrial averages of the corresponding period, and

$$\begin{aligned} X_{it} &: \text{Output of } i\text{-th firm in period } t, \\ j_{it} &: \text{Input } j \ (j = \ K(\text{capital}),\ L(\text{labor}),\ M(\text{materials})) \text{ of} \\ &\quad i\text{-th firm in period } t, \text{and} \\ S_{j,i,t} &: \text{ Share of input } j \text{ of } i\text{-th firm in period } t. \end{aligned}$$

That is to say, the log of TFP measures the productivity level relative to the productivity of average firm in the corresponding industry in the starting year. The log of TFP is composed of real output, three inputs (capital, labor and materials) and their corresponding shares. The sources and the construction method of the data are explained in detail in the appendix to this paper.

Total Factor Productivity The industry average and median of log of TFP for individual firms from 1995 to 2007 are presented in Figures 3 to 5. The figures demonstrate that productivity of each industry turns to a stable increasing trend around 2000. In fact, for the period of 1996−2001 the mean growth rates of TFP, or the first difference of the log of TFP, are 0.0013, 0.0312 and 0.0109 for general machinery, electrical machinery, and transportation equipment, respectively, while they rise substantially to 0.0261, 0.0698, and 0.0193 for the period of 2002-2007.

Figure 3: Log of TFP by Year: General Machinery

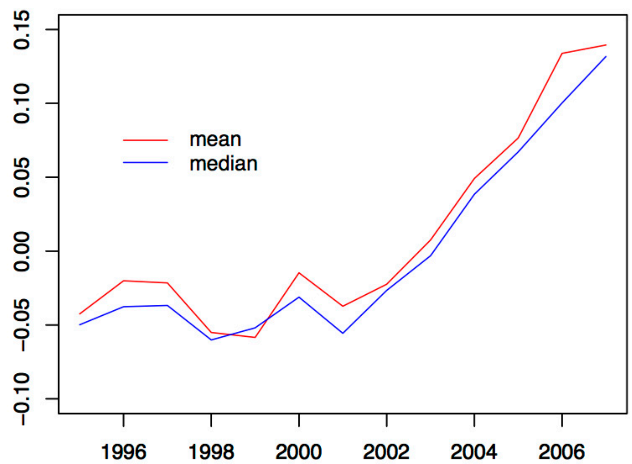


Figure 4: Log of TFP by Year: Electrical Machinery

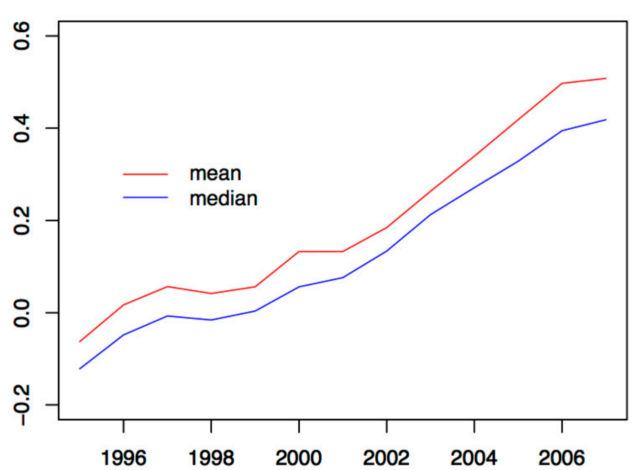
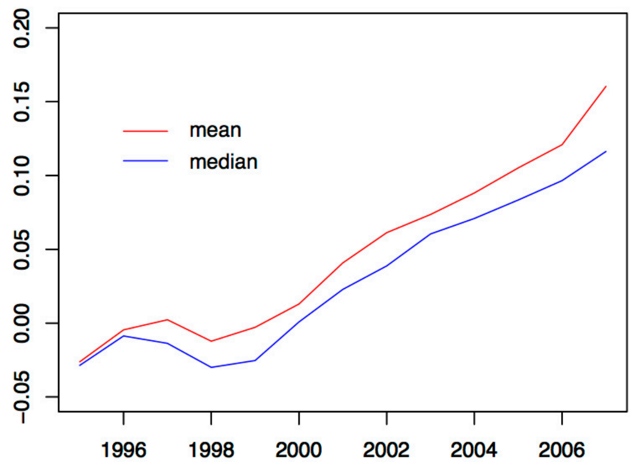


Figure 5: Log of TFP by Year: Transportation Equipment



Price-Cost Margin The second variable, the price-cost margin, is calculated as the value of output divided by the total cost, where the total cost (TC) is the sum of labor, material, and capital cost:

$$TC = wL + p_M M + rK.$$

The cost shares, S_K, S_L, and S_M, used in constructing TFP is obtained by dividing each factor cost by the total cost.

The reduction of the production cost through a rise in total factor productivity may increase the price-cost margin as long as the output price remains constant, resulting in higher profitability. Figures 6 to 8 show the mean and median of price-cost margin for each industry. Price-cost margin of general machinery and transportation equipment also has a turning point around 2000 and exhibits an increasing trend thereafter.

For the electrical machinery sector, the price-cost margin remains almost constant for whole sample period, while the log of TFP shows a sharp upward trend after 2001. This could occur when productivity gain does not lead to higher price-cost margins, or higher profitability, due to a fierce international competition and the output price level comes down concurrently.

Figure 6: Price-Cost Margin by Year: General Machinery

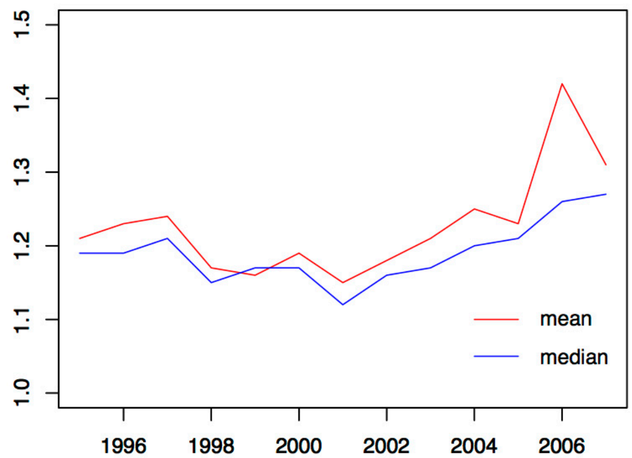


Figure 7: Price-Cost Margin by Year: Electrical Machinery

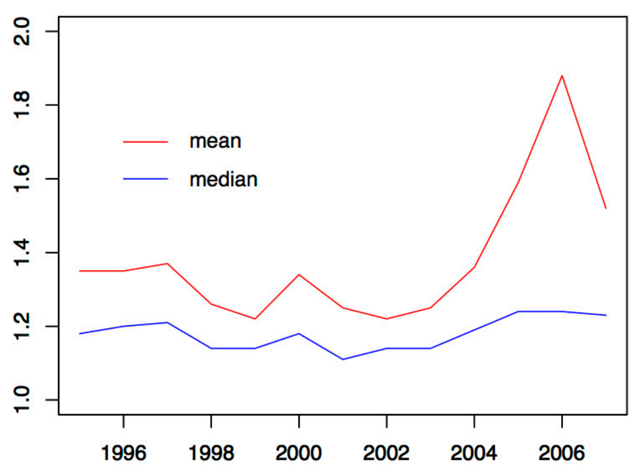
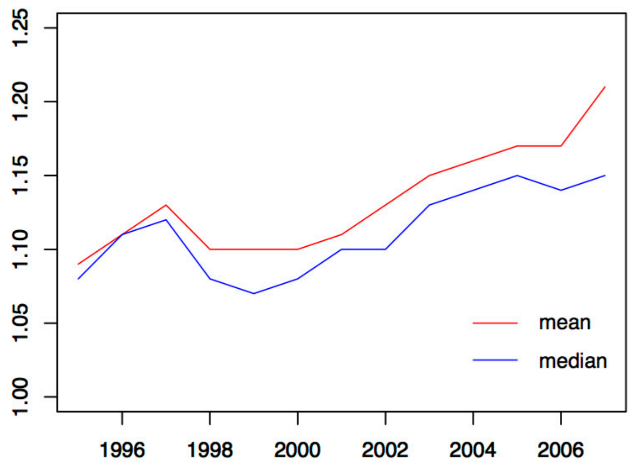


Figure 8: Price-Cost Margin by Year: Transporation Equipment



Real Exports Finally, our third key variable, real exports, is obtained by deflating the value of exports ($p_E Q_E$) by the price index of exports (p_E). Industry average and median of real exports are presented in Figures 9 to 11. Exports exhibit an increasing trend starting around 2000, irrespective of industry. Exports and productivity move in tandem in the 21st century. We will discuss this relationship in detail based on the econometric analysis in the next section.

Figure 9: Real Export by Year: General Machinery

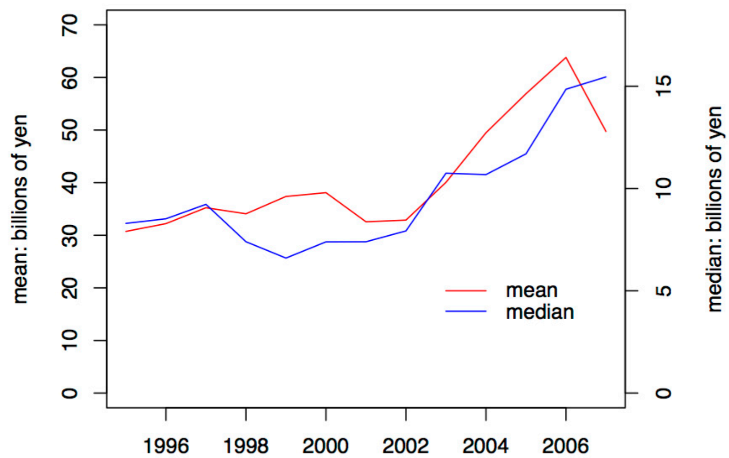


Figure 10: Real Export by Year: Electrical Machinery

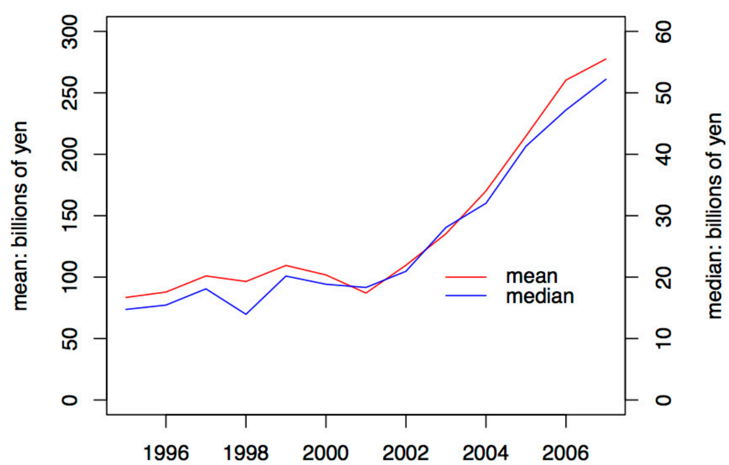
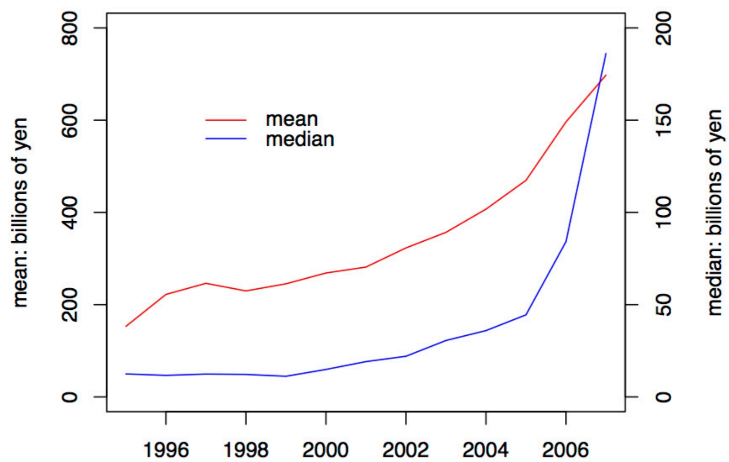


Figure 11: Real Export by Year: Transportation Equipment



IV. Estimation Results and Implications

A. Export Functions

We estimate the export function derived in Section 2 under two specifications with and without bank health variable. The export function to be estimated is given by

$$\log(Q_E)_{it} = \alpha_0 + \alpha_1 \log(PCOST)_{it} + \alpha_2 \log(y_E)_t + \alpha_3 \log\left(\frac{p_E}{ep_W}\right)_t \\ +\alpha_4 \log(A)_{it} + \alpha_5 LEND_t + \nu_i + u_{it}, \tag{16}$$

where

$PCOST_{it}$; price-cost margin,
$LEND_t$; lending attitude of financial institute,
ν_i; firm-specific term, and
u_{it}; disturbance term.

In eq.(16) both world income and relative prices are industry-specific and we do not include time dummies as explanatory variables since our ultimate goal of this paper is to compare the relative contribution of world income and TFP to export.[8] We take the endogeneity of price-cost margin into consideration explicitly in estimating export function. Price-cost margin is one of the important determinants of export in our model. However, the price-cost margin variable is constructed only from the information contained in balance sheet and profit-and-loss statements. Thus unobservable important information such as the values of overseas network is not reflected on our price-cost margin variable. Then the observable price-cost margin might include measurement errors. Straight application of conventional panel estimation might yield downward bias of the estimates. In this case the instrumental variable (IV) estimator is a legitimate procedure to allow for endogeneity. Candidates for instrument are ingredients of cost function; which are $\log(w/p_E)$, $\log(r/p_E)$, $\log(T)$, $\log(DEBT)$ and 12 time dummy variables. The preliminary estimation, however, reveals that if we adopt all the explanatory variables in the cost function as instruments, the Sargan test decisively rejected the overidentification restrictions, so that we use only part of the instruments that do not violate the overidentification restrictions. Therefore, we use the log of TFP and lagged debt-asset ratio as valid instruments for the price-cost margin that do not violate the overidentification restrictions. The estimation is conducted for the whole sample and each industry. The Hausman specification test is applied for selection between fixed-effect model and random-effects model.

Tables 2 and 3 show the estimation results of the export function. We report the estimation results of the export function by both panel IV estimation (Table 2) and simple panel estimation (Table 3). It should be noted that the coefficient estimate of the price-cost margin by simple panel estimation is much smaller than that by IV estimation. This indicates that application of simple panel estimation yields biased estimates due to measurement error contained in the price-cost margin. Therefore the following discussions are based on the estimation results by IV method.

The coefficient estimate of world income is significantly positive, irrespective of industry and specification. The income elasticity of export ranges from 0.580 (general machinery) to 1.150 (transportation equipment). The price-cost margin has significantly positive effect on exports, irrespective of industry and specification. The elasticity of export with respect to price-cost margin is 0.438 (general machinery) to 1.494 (transportation equipment). Our finding of positive relationship between the price-cost margin and exports is consistent with Loecker and Warzynski (2009). They find that exporters have on average higher markups for Slovenian firms.

Firm size, measured by total assets, exerts a significantly positive effect on exports, as is confirmed by many studies. The coefficient estimate of lending attitude is also significantly positive, irrespective of industry. It implies that severe lending attitude of financial institutions reduces exports. Our finding is consistent with Amiti and Weinstein (2011) finding that trade finance provided by the financial institutions affects exports of Japanese firms.

[8] World income is caluculated as the weighted average of GDP of eight regions (Asia, Middle East, Western Europe, Russia, Eastern Europe, North America, Oceania and Africa), where the weights are constructed using industry-specific Japanese export share to each region.

Table 2: Estimation results of export function (Panel IV method)

	(1) Whole sample	(2) General machinery	(3) Electrical machinery	(4) Transportation equipment
	Panel A:	Fixed effect model		
$\log(PCOST)$	1.128 (11.7) **	0.599 (4.32) **	0.908 (7.83) **	1.494 (4.04) **
$\log(y_E)$	0.856 (8.32) **	0.580 (4.27) **	0.875 (3.30) **	0.922 (4.46) **
$\log(p_E/ep_W)$	-0.335 (2.59) **	-1.434 (7.75) **	-0.058 (0.23)	-0.747 (1.25)
$\log(A)_{-1}$	0.959 (20.3) **	0.589 (6.86) **	1.095 (13.0) **	0.813 (10.2) **
Constant term	-15.220 (10.4) **	-6.892 (3.19) **	-16.844 (4.54) **	-14.455 (4.91) **
Overall R^2	0.721	0.685	0.695	0.816
Sargan $\chi^2(1)$	2.81 (0.09)	0.16 (0.69)	2.88 (0.09)	3.85 (0.05) *
	Panel B:	Random effect model		
$\log(PCOST)$	0.992 (10.6) **	0.515 (3.60) **	0.826 (7.48) **	1.224 (3.34) **
$\log(y_E)$	0.696 (7.19) **	0.519 (3.72) **	0.763 (3.22) **	0.603 (3.04) **
$\log(p_E/ep_W)$	-0.405 (3.15) **	-1.348 (7.02) **	-0.122 (0.50)	-0.431 (0.72)
$\log(A)_{-1}$	1.121 (33.8) **	0.894 (15.1) **	1.182 (21.1) **	1.077 (17.5) **
Constant term	-14.575 (10.0) **	-9.460 (4.26) **	-16.065 (4.57) **	-12.628 (4.27) **
Overall R^2	0.734	0.703	0.701	0.829
Sargan $\chi^2(1)$	3.42 (0.06)	1.88 (0.17)	1.96 (0.16)	4.39 (0.04) *
Hausman $\chi^2(4)$	67.77 (0.00) **	18.92 (0.00) **	7.04 (0.13)	33.31 (0.00)**
	Panel C:	Fixed effect model with bank's lending attitude		
$\log(PCOST)$	0.948 (9.86) **	0.438 (3.16) **	0.809 (6.73) **	1.136 (3.20) **
$\log(y_E)$	0.964 (9.53) **	0.638 (4.73) **	1.032 (3.87) **	1.150 (5.62) **
$\log(p_E/ep_W)$	-0.196 (1.53)	-1.178 (5.94) **	-0.111(0.45)	-0.146 (0.24)
$\log(A)_{-1}$	0.922 (19.9) **	0.593 (7.03) **	1.070 (12.8) **	0.750 (9.54) **
$LEND$	0.0039 (6.29) **	0.0032 (3.45) **	0.0035 (2.92) **	0.0048 (4.42) **
Constant term	-16.513 (11.5) **	-7.847 (3.66) **	-19.068 (5.10) **	-17.339 (5.99) **
Overall R^2	0.727	0.695	0.698	0.818
Sargan $\chi^2(1)$	3.25 (0.07)	0.26 (0.61)	2.43 (0.12)	5.15 (0.02) *
	Panel D:	Random effect model with bank's lending attitude		
$\log(PCOST)$	0.832 (8.94) **	0.356 (2.49) **	0.733 (6.43) **	0.931 (2.62) **
$\log(y_E)$	0.787 (8.25) **	0.583 (4.23) **	0.897 (3.78) **	0.783 (3.97) **
$\log(p_E/ep_W)$	-0.270 (2.12) *	-1.079 (5.27) **	-0.169 (0.70)	0.092 (0.15)
$\log(A)_{-1}$	1.095 (33.1) **	0.879 (14.8) **	1.168 (20.9) **	1.031 (16.7) **
$LEND$	0.0038 (6.05) **	0.0035 (3.55) **	0.0036 (3.07) **	0.0040 (3.66) **
Constant term	-15.727 (11.0) **	-10.295 (4.69) **	-18.065 (5.12) **	-14.966 (5.13) **
Overall R^2	0.738	0.708	0.703	0.831
Sargan $\chi^2(1)$	3.64 (0.06)	1.99 (0.16)	1.60 (0.21)	5.27 (0.02) *
Hausman $\chi^2(5)$	35.06 (0.00) **	17.53 (0.00) **	6.80 (0.24)	31.72 (0.00) **

Note: The figures in parentheses are the t-values in absolute value for coefficients and p-values for χ^2 statistics. Asterisks * and ** indicate that the corresponding coefficients are significant at the 5% and 1% level, respectively. Sargan χ^2 and Hausman χ^2 stand for the test statistics with degree of freedom in parentheses for over identification restriction and model specification, respectively.

Table 3: Estimation results of export function (Simple panel method)

	(1) Whole sample	(2) General machinery	(3) Electrical machinery	(4) Transportation equipment
	Panel A:	Fixed effect model		
$\log(PCOST)$	0.251 (4.81) **	0.127 (1.40)	0.303(4.51) **	0.278 (1.15)
$\log(y_E)$	0.925 (9.55) **	0.575 (4.30) **	1.145 (4.56) **	1.083 (5.47) **
$\log(p_E/ep_W)$	-0.637 (5.35) **	-1.555 (8.63) **	-0.478 (2.06) *	-1.377 (2.44) *
$\log(A)_{-1}$	1.006 (22.6) **	0.602 (7.13) **	1.113 (13.7) **	0.867 (11.3) **
Constant term	-16.721 (12.2) **	-6.885 (3.24) **	-21.223 (6.05) **	-17.555 (6.30) **
Overall R^2	0.742	0.703	0.708	0.832
	Panel B:	Random effect model		
$\log(PCOST)$	0.238 (4.62) **	0.106 (1.15) **	0.292 (4.43) **	0.183 (0.75)
$\log(y_E)$	0.795 (8.64) **	0.520 (3.85) **	1.008 (4.45) **	0.776 (4.07) **
$\log(p_E/ep_W)$	-0.659 (5.54) **	-1.474 (8.03) **	-0.490 (2.12) *	-1.015 (1.78)
$\log(A)_{-1}$	1.123 (33.3) **	0.853 (13.6) **	1.192 (21.5) **	1.098 (18.2) **
Constant term	-16.047 (11.8) **	-8.942 (4.16) **	-19.981 (5.96) **	-15.535 (5.54) **
Overall R^2	0.743	0.709	0.708	0.836
Hausman $\chi^2(4)$	25.56 (0.00) **	17.48 (0.00) **	2.63 (0.62)	24.00 (0.00) **
	Panel C:	Fixed effect model with bank's lending attitude		
$\log(PCOST)$	0.192 (3.70) **	0.073 (0.81)	0.242 (3.57) **	0.213 (0.90)
$\log(y_E)$	1.050 (10.9) **	0.643 (4.82) **	1.342 (5.32) **	1.281 (6.47) **
$\log(p_E/ep_W)$	-0.398 (3.31) **	-1.223 (6.24) **	-0.495 (2.16) *	-0.585 (1.01)
$\log(A)_{-1}$	0.949 (21.4) **	0.603 (7.22) **	1.073 (13.3) **	0.787 (10.3) **
LEND	0.0050 (8.62) **	0.0038 (4.11) **	0.0052 (4.72) **	0.0050 (4.72) **
Constant term	-18.090 (13.3) **	-7.999 (3.76) **	-23.927 (6.80) **	-19.791 (7.16) **
Overall R^2	0.740	0.706	0.708	0.829
	Panel D:	Random effect model with bank's lending attitude		
$\log(PCOST)$	0.184 (3.58) **	0.051 (0.55)	0.235 (3.55) **	0.126 (0.52)
$\log(y_E)$	0.895 (9.78) **	0.592 (4.38) **	1.165 (5.14) **	0.925 (4.85) **
$\log(p_E/ep_W)$	-0.437 (3.63) **	-1.132 (5.67) **	-0.505 (2.21) *	-0.314 (0.53)
$\log(A)_{-1}$	1.086 (32.2) **	0.849 (13.7) **	1.172 (21.1) **	1.045 (17.1) **
LEND	0.0048 (8.18) **	0.0039 (4.14) **	0.0051 (4.65) **	0.0043 (3.97) **
Constant term	-17.247 (12.7) **	-10.048 (4.68) **	-22.277 (6.64) **	-17.309 (6.20) **
Overall R^2	0.743	0.706	0.708	0.836
Hausman $\chi^2(5)$	9.70 (0.08)	17.08 (0.00) **	3.34 (0.65)	31.01 (0.00) **

The figures in parentheses are the t-values in absolute value for coefficients and p-values for χ^2 statistics. Asterisks * and ** indicate that the corresponding coefficients are significant at the 5% and 1% level, respectively. Hausman χ^2 stands for the test statistics with degree of freedom in parentheses for model specification.

B. Price-Cost Margin Equation

In this section we regress the price-cost margin on its determinants. The price-cost margin equation is important since it is used for evaluating quantitatively the contribution of TFP and other determinants to the cost function of exports, our ultimate goal of this paper. The price-cost margin equation to be estimated is written as

$$\log(PCOST)_{it} = \beta_0 + \beta_1 \log\left(\frac{w}{p_E}\right)_{it} + \beta_2 \log\left(\frac{r}{p_E}\right)_{it} + \beta_3 \log(T)_{it} + \beta_4 \log(DEBT)_{it} + \sum_s \beta_{5s} DY_{st} + \nu_i + u_{it}, \tag{17}$$

where

$$DEBT_{it};\ \text{debt-asset ratio, and}$$
$$DY_{st};\ \text{time dummies } (t = 1996, \ldots, 2007).$$

We add the debt-asset ratio and time dummies to the list of explanatory variables. Note that the material price is common to all the firms in the sample, so that it is subsumed into the time dummies. Table 4 shows the estimation results.

The coefficient estimates of factor prices are all significantly negative. This implies that a rise in factor prices lowers the price-cost margin. The TFP variable has a significantly positive effect on the price-cost margin, irrespective of industry. An one-percent rise in TFP increases the price-cost margin by 0.985 percent (transportation equipment) to 1.334 percent (general machinery).

Table 4: Estimation results of price-cost margin function

	(1) Whole sample	(2) General machinery	(3) Electrical machinery	(4) Transportation equipment
	Panel A:	Fixed effect model		
$\log(r/p_E)$	-0.339 (68.9) **	-0.347 (51.0) **	-0.521 (68.5) **	-0.177 (49.6) **
$\log(w/p_E)$	-0.209 (18.4) **	-0.317 (23.4) **	-0.298 (15.4) **	-0.164 (21.6) **
$\log TFP$	1.182 (68.8) **	1.334 (46.7) **	1.047 (53.2) **	0.985 (59.0) **
$\log(DEBT)$	-0.040 (4.15) **	-0.081 (7.57) **	-0.031 (2.47) *	0.009 (1.27)
DY1996	-0.076 (12.0) **	-0.033 (4.47) **	-0.105 (12.9) **	-0.060 (15.4) **
DY1997	-0.179 (26.8) **	-0.172 (21.3) **	-0.212 (25.1) **	-0.092 (21.7) **
DY1998	-0.087 (13.8) **	-0.027 (3.68) **	-0.086 (10.4) **	-0.065 (17.1) **
DY1999	-0.022 (3.34) **	-0.010 (1.29)	0.084 (8.65) **	-0.015 (4.00) **
DY2000	-0.033 (4.99) **	0.022 (2.83) **	0.013 (1.25)	0.001 (0.17)
DY2001	-0.055 (8.11) **	0.019 (2.40) *	0.023 (2.01) *	-0.039 (9.76) **
DY2002	-0.079 (11.1) **	-0.049 (6.35) **	0.068 (5.17) **	-0.049 (11.6) **
DY2003	-0.090 (12.0) **	-0.052 (6.41) **	0.144 (9.24) **	-0.093 (20.4) **
DY2004	-0.180 (22.4) **	-0.159 (18.5) **	0.023 (1.39)	-0.135 (27.8) **
DY2005	-0.226 (26.7) **	-0.145 (16.4) **	-0.090 (5.29) **	-0.177 (32.8) **
DY2006	-0.355 (38.7) **	-0.376 (37.4) **	-0.183 (10.4) **	-0.214 (36.5) **
DY2007	-0.312 (33.2) **	-0.302 (29.7) **	-0.034 (1.81)	-0.250 (38.1) **
Constant term	1.124 (11.7) **	1.937 (17.0) **	1.493 (9.44) **	1.047 (16.9) **
Overall R^2	0.834	0.856	0.952	0.963
	Panel B:	Random effect model		
$\log(r/p_E)$	-0.327 (69.1) **	-0.335 (50.8) **	-0.496 (71.5) **	-0.172 (48.9) **
$\log(w/p_E)$	-0.175 (16.8) **	-0.271 (22.2) **	-0.269 (17.5) **	-0.167 (25.7) **
$\log TFP$	1.086 (78.0) **	1.229 (50.9) **	0.904 (72.4) **	1.000 (85.5) **
$\log(DEBT)$	-0.032 (4.31) **	-0.024 (3.41) **	-0.037 (4.65) **	-0.001 (0.28)
DY1996	-0.071 (10.9) **	-0.030 (3.79) **	-0.093 (11.0) **	-0.059 (14.7) **
DY1997	-0.169 (24.8) **	-0.162 (18.9) **	-0.192 (22.0) **	-0.090 (20.9) **
DY1998	-0.083 (12.9) **	-0.023 (2.94) **	-0.076 (8.82) **	-0.065 (16.5) **
DY1999	-0.023 (3.44) **	-0.010 (1.21)	0.086 (8.85) **	-0.015 (3.89) **
DY2000	-0.033 (4.77) **	0.022 (2.70) **	0.025 (2.45) *	-0.000 (0.01)
DY2001	-0.056 (7.99) **	0.019 (2.28) *	0.028 (2.56) **	-0.039 (9.91) **
DY2002	-0.077 (10.6) **	-0.045 (5.41) **	0.077 (6.19) **	-0.050 (12.1) **
DY2003	-0.085 (11.2) **	-0.044 (5.11) **	0.157 (10.8) **	-0.093 (21.0) **
DY2004	-0.169 (20.9) **	-0.144 (15.9) **	0.052 (3.47) **	-0.135 (29.0) **
DY2005	-0.212 (25.0) **	-0.129 (13.9) **	-0.049 (3.19) **	-0.176 (34.4) **
DY2006	-0.333 (36.5) **	-0.347 (33.3) **	-0.132 (8.33) **	-0.213 (38.0) **
DY2007	-0.288 (31.2) **	-0.272 (26.2) **	0.014 (0.85)	-0.249 (40.5) **
Constant term	0.870 (9.87) **	1.624 (15.6) **	1.307 (10.4) **	1.081 (20.3) **
Overall R^2	0.833	0.883	0.954	0.965
Hausman $\chi^2(16)$	196.4(0.00)**	5201.6(0.00)**	175.0(0.00)**	110.7(0.00)**

The figures in parentheses are the t-values in absolute value for coefficients and p-values for χ^2 statistics. Asterisks * and ** indicate that the corresponding coefficients are significant at the 5% and 1% level, respectively. Hausman χ^2 stands for the test statistics with degree of freedom in parentheses for model specification.

C. Reverse Causality from Exports to Productivity

Positive effect of productivity on exports has been confirmed by many studies. However, the reverse causality has been also discussed, though the evidence is mixed in the literature.[9] The exporters might increase their productivity through various channels. First, interaction with foreign competitors provides information about process and product reducing costs. This channel is called learning by exporting. Second, exporting enables firms to increase scale. Finally fierce competition in overseas market forces firms to become more efficient and stimulates innovation. If the causality runs from exports to productivity, then our story should be modified accordingly. It is not strenuous re-structuring efforts by firms, but an exogenous export surge for Japanese goods from China and Asian NIEs, that contributed to an increase in productivity of exporters. Therefore it is important to conduct this reverse causality test from exports to productivity to distinguish between two different stories on the primary factors that pulled the Japanese economy out of the lost decade.

We estimate the following dynamic TFP equation.

$$\log(T)_{it} = \gamma_0 + \gamma_1 \log\left(\frac{CFLOW}{SALES}\right)_{it} + \gamma_2 \log(DEBT)_{it} + \gamma_3 \log(A)_{it} + \gamma_4 \log(Q_E)_{i,t-1} + \gamma_5 \log(T)_{i,t-1} + \sum_s \gamma_{6s} DY_{st} + \nu_i + u_{it}, \qquad (18)$$

where

$$CFLOW_{it}; \text{cash flow, and}$$
$$SALES_{it}; \text{sales.}$$

We assume that TFP depends on the ratio of cash flow to sales, debt-asset ratio, firm size and lagged exports. The ratio of cash flow to sales might affect TFP by way of firm's R&D activities. R&D investment crucially hinges upon cash flow since R&D investment in general is not accompanied by purchase of collateralizable assets.[10] Eq.(18) is estimated by Arellano-Bond procedure. The instruments are the first difference of the lagged explanatory variables. Estimation results are shown in Table 5. The ratio of cash flow to sales has a significantly positive effect on TFP across industries. As for the effects of exports, the coefficient of lagged exports is not statistically significantly positive in any industries. Therefore our evidence suggests that productivity affects exports, but not the other way around.

[9] As for the evidence of productivity improvement upon entry into export markets, see, for example, Van Biesebroeck (2005). He reports evidence that exporting raises productivity for sub-Saharan African manufacturing firms.

[10] See Ogawa (2007) for the importance of cash flow in R&D activities for Japanese manufactures during the financial crisis of the late 1990s to the early 2000s.

Table 5: Estimation results of log of TFP function

	(1) Whole sample	(2) General machinery	(3) Electrical machinery	(4) Transportation equipment
$\log TFP_{-1}$	0.394 (13.1) **	0.204 (4.71) **	0.401 (10.3) **	0.371 (4.25) **
$\log(DEBT)$	-0.054 (3.40) **	-0.096 (4.99) **	0.033 (1.23)	0.037 (1.23)
$CFLOW/SALES$	1.248 (16.7) **	1.114 (13.1) **	1.880 (12.5) **	0.649 (4.41) **
$\log(A)_{-1}$	0.037 (1.95)	0.002 (0.08)	-0.078 (1.96) *	0.033 (1.56)
$\log(QE)_{-1}$	-0.004 (0.60)	0.002 (0.25)	-0.024 (1.94)	-0.010 (1.14)
DY1997	0.003 (0.42)	0.000 (0.01)	0.025 (2.37) *	0.002 (0.25)
DY1998	-0.018 (2.84) **	-0.030 (3.29) **	0.019 (1.62)	-0.012 (1.42)
DY1999	0.006 (0.96)	-0.011 (1.14)	0.047 (3.77) **	-0.003 (0.29)
DY2000	0.043 (6.33) **	0.025 (2.75) **	0.103 (7.42) **	0.011 (1.17)
DY2001	0.031 (3.85) **	0.001 (0.09)	0.125 (7.15) **	0.035 (3.48) **
DY2002	0.062 (7.68) **	0.019 (1.94)	0.175 (9.63) **	0.042 (3.64) **
DY2003	0.083 (9.63) **	0.029 (2.80) **	0.217 (10.9) **	0.044 (3.61) **
DY2004	0.104 (10.7) **	0.050 (4.67) **	0.266 (11.2) **	0.053 (3.99) **
DY2005	0.114 (10.3) **	0.067 (5.55) **	0.284 (10.6) **	0.066 (4.59) **
DY2006	0.139 (11.2) **	0.082 (6.09) **	0.349 (11.8) **	0.080 (5.03) **
DY2007	0.157 (11.5) **	0.102 (6.85) **	0.380 (11.7) **	0.114 (6.58) **
Constant term	-0.478 (2.30) *	-0.185 (0.68)	1.070 (2.49) *	-0.304 (1.22)
Test for autocorrelation (2).	-1.616(0.11)	-1.237(0.22)	-1.286(0.20)	-1.398(0.16)

The figures in parentheses are the z-values in absolute value. Asterisks * and ** indicate that the corresponding coefficients are significant at the 5% and 1% level, respectively.

V. External Demand versus Productivity Gain

In this section we calculate the extent to which each determinant of export contributed to the export surge in the 2000s that helped the Japanese economy get out of the lost decade. In so doing we evaluate the relative importance of demand and supply factors in exporting behavior of Japanese firms during this period. Specifically we calculate the contribution of world demand, relative prices, firm size, lending attitude of the financial institutions, price-cost margin and its components: wage rate, rental price of capital and TFP to export variations in the 1990s to 2000s. Based on the estimates of the export function as well as those of the price-cost margin equation, the contribution of world demand to export is calculated as the proportion of the rate of change in exports explained by the rate of change in world demand or

$$\frac{\alpha_2\left(\log(y_E)_{i,t+T} - \log(y_E)_{i,t}\right)}{\log(Q_E)_{i,t+T} - \log(Q_E)_{i,t}}. \tag{19}$$

Similarly, the contribution of the price-cost margin, real exchange rate, firm size and lending attitude of the financial institutions to export is calculated, using the corresponding coefficient estimates of the export equation. The contribution of each component of the price-cost margin can be also obtained by using the coefficient estimates of the export function and the price-cost margin function. For example, the contribution of TFP to export is given by

$$\frac{\alpha_1\beta_3\left(\log(T)_{i,t+T} - \log(T)_{i,t}\right)}{\log(Q_E)_{i,t+T} - \log(Q_E)_{i,t}}. \tag{20}$$

Productivity gains are much more important than growth in external demand in explaining export growth during 1999-2007. The contribution of different variables in explaining export growth during this period is calculated for all the firms that existed for the entire period. The upper and lower panels of Table 6 show the mean and median of the frequency distribution of the contribution of each variable across firms. Let us first focus on the first columns in each pair, which report results based on regressions without the lending attitude diffusion index, LEND. It is important to note first that growth in firm size, measured by the growth rate of asset size, is the most important contributor in explaining export growth, except for general machinery[11]: for example, the median of the frequency distribution of the contribution of $log(A)_{-1}$ ranges between 44.8 percent for the whole sample and 66.2 percent for electrical machinery. Productivity gains, measured by the growth rate of TFP, is the second or the third largest contributor: the median of the frequency distribution of the contribution of $logTFP$ ranges between 24.8 percent for general machinery and 48.0 percent for the whole sample. On the other hand, contributions of growth in external demand are much smaller than those of productivity gains: the median of the frequency distribution of the contribution of $log(y_E)$ is at most 16.5 percent for the whole sample.

Table 6: Contribution of each independent variable to export: 1999-2007

	(1) Whole sample		(2) General machinery		(3) Electrical machinery		(4) Transportation equipment	
				mean				
$\log(y_E)$	0.368	0.414	0.130	0.143	0.541	0.636	0.293	0.366
$\log(p_E/ep_W)$	0.054	0.032	0.463	0.380	-0.026	-0.035	0.383	0.075
$\log(A)_{-1}$	1.055	1.015	0.179	0.180	2.378	2.350	0.785	0.724
$LEND$		0.241		0.145		0.114		0.688
$\log(PCOST)$	0.523	0.440	0.142	0.104	0.420	0.372	1.188	0.903
$\log TFP$	1.388	1.166	0.255	0.187	1.411	1.252	1.949	1.482
$\log(w/p_E)$	-0.146	-0.123	0.014	0.010	-0.356	-0.315	-0.108	-0.082
$\log(r/p_E)$	0.613	0.515	0.150	0.110	-0.177	-0.157	1.758	1.337
$\log(DEBT)$	0.020	0.017	0.015	0.011	0.011	0.010	-0.009	-0.007
				median				
$\log(y_E)$	0.165	0.185	0.129	0.142	0.160	0.188	0.060	0.075
$\log(p_E/ep_W)$	0.035	0.020	0.458	0.376	-0.008	-0.010	0.078	0.015
$\log(A)_{-1}$	0.448	0.431	0.126	0.127	0.662	0.654	0.498	0.459
$LEND$		0.103		0.134		0.037		0.137
$\log(PCOST)$	0.105	0.089	0.090	0.066	0.068	0.060	0.149	0.113
$\log TFP$	0.480	0.404	0.248	0.182	0.401	0.356	0.284	0.216
$\log(w/p_E)$	-0.040	-0.034	-0.005	-0.004	-0.128	-0.114	-0.005	-0.004
$\log(r/p_E)$	0.173	0.146	0.108	0.079	-0.072	-0.064	0.371	0.282
$\log(DEBT)$	0.004	0.003	0.007	0.005	0.001	0.000	-0.001	-0.001

The importance of TFP as a driving force of exports remains essentially unaltered when the lending attitude variable is taken into consideration in estimating export function. As shown in the second columns in each pair, the proportion of export variations explained by TFP ranges from 18.2 percent for general machinery to 40.4 percent for the whole

[11] The exchange rate appears to be the main contributor to export growth in general machinery.

sample. On the other hand the contribution of world demand to export is limited as the ratio of export variations explained by world demand is at most 18.8 percent for electrical machinery.

VI. Concluding Remarks

The surge of exports in the early 2000s helped the Japanese economy pull out of the lost decade. We find that this increasing trend of Japanese exports during this period was helped by the so-called divine wind or the large exogenous overseas demand for exports, but was largely explained by substantial improvement of productivity of exporters. Kwon et al. (2008) showed that the acceleration of TFP growth of Japanese manufacturers since the early 2000s mainly reflected restructuring efforts by incumbent firms to reduce labor and capital costs. The upshot is that without firms' ceaseless efforts to raise productivity and strengthen international competitiveness, the steady growth of the 2000s out of the lost decade might not have happened.

Appendix: Data Appendix

In this appendix we explain in details the sources and the procedure to construct the data used in this study. The primary data source is the set of unconsolidated financial statements of firms listed on Tokyo Stock Exchange, 1st Section. The database is provided in electronic base by Nikken Inc. as NEEDS database.

Our analysis focuses on the machinery-manufacturing firms since these firms played a vital role in the recovering process from the lost decade by exporting activities. The data are basically collected on firm basis. However, when data are only available in industry aggregates, we use the same values commonly to the individual firms within the same industry. Data are also summarized in terms of descriptive statistics from Tables A1 to A3 in this appendix.

1. TFP and Related Data

As was explained in the text, the log of TFP is composed of real output, three inputs (capital, labor and materials) and their corresponding shares. Each component is constructed as follows:

Nominal output (pX), output price (p) and real output (X) Our definition of total cost of production does not include the cost of production of unfinished goods that are carried over from the previous year, but does include the cost of production of goods that are produced but not sold and carried over to the next year in terms of both finished and in-process inventories.

Accordingly, we should add the change in these inventories of current period to the sales amount to construct the consistent output with production cost. These data are drawn from NEEDS as follows:

- pX :Sales Amount + (Ending Finished Good Inventory − Beginning Finished Good Inventory) + (Ending In-process Inventory − Beginning In-process Inventory).
- p: Corporate Goods Price Index by Sector by Bank of Japan.

Real output (X) is obtained by deflating the nominal output (pX) by output price (p). Since the output price (p) is not available for individual firms, we use the industry average prices and apply them commonly to the firms within the same industry.

Labor cost (wL), wage rate (w) and labor input (L) The data for labor cost are also drawn from NEEDS as follows:

- wL: Welfare Expense + Transfer from Reserve for Retirement Allowance + Wage Payment.

- L: Labor input measured as the total working hour per year ($Ne \times wh$).
- Ne: Number of Employees in NEEDS
- wh: Hours Worked classified by Economic Activities in Annual Report on National Account, Cabinet Office, Government of Japan.

Since working hours is available only for the industrial average, they are common to all the firms within the same industry. Wage rate (w) is obtained by dividing labor cost (wL) by the product of the number of employees and yearly working hours ($L = Ne \times wh$) described above.

Material cost ($p_M M$), material price (p_M) and material input (M)

- $p_M M$: Cost of Materials + Outsourced Manufacturing Fees + Power and Fuel Expense in Manufacturing Statement + Advertising Cost + Transportation Cost and Storage Fee in Selling and Administrative Expense in NEEDS.
- p_M: Input price index (calendar year of 2000 = 100) by Bank of Japan.

Real material input (M) is obtained by deflating the above material cost ($p_M M$) by material price. The material price (p_M) is also applied commonly to the firms within the same industry.

Capital cost (rK), rental price of capital (r) and gross capital stock (K)
Capital cost is the product of rental price of capital (r) and the gross capital stock in constant price (K). The data on gross capital stock is provided by Professors Taiji Hagiwara and Yoichi Matsubayashi. They compile the gross capital stock series in 2000 constant prices by perpetual inventory method base on the financial statements of the Japanese individual firms. The detailed explanation on sources of the data and the construction method are provided in Hagiwara and Matsubayashi (2010).

The rental price of capital (r) is calculated as follows:

$$r = q\left(i + \delta - \frac{\dot{q}}{q}\right)$$

where

- q: Price index of investment goods; Investment Goods Price Index (average of calendar year of 2000 = 100) by Bank of Japan as the price index of investment goods (q).
- δ: Physical depreciation rate of capital stock; Net Retirement (at market price in calendar year of 2000) divided by Gross Capital Stock in Constant Price (at market price in calendar year of 2000) in Gross Capital Stock by Cabinet Office, Government of Japan, and

- i: Interest rate; Interest and Discount Expense divided by (Short-term Loans + Long-term Loans + Corporate Bonds + Employee Deposits+Balance of Notes Receivable).

Price index of investment goods (q), and the physical depreciation cost (δ) are common to all the firms within the same industry. The corresponding cost shares (S_L, S_M, and S_K can be obtained by dividing each nominal cost by the total cost ($wL + p_M M + rK$).

Using nominal output and total cost, price-cost margin ($PCOST$) is defined as

$$PCOST = \frac{pX}{wL + p_M M + rK}$$

2. Exports and Related Data

Nominal export ($p_E Q_E$), export price (p_E) and real export (Q_E)

- $p_E Q_E$: Export Sales Amount in NEEDS
- p_E: Export Price Index (yen basis, 2000 base) by Bank of Japan

Real export is obtained by deflating the nominal export ($p_E Q_E$) by the price index of export goods (p_E).

World demand (y_E) World demand (y_E) is constructed as a weighted average of the GDPs (in constant price of 2005 US dollar) of the eight regions (Asia, Middle East, Western Europe, Russia and East Europe, North America, Middle and South America, Oceania, and Africa) in each year. The weights are the export share of the corresponding eight regions, which are calculated for each industry.

World price (p_W) Since world price is not available by industry, we use the import goods price (p_{IM}) as a proxy of world price. The yen-denominated export price is converted into the dollar-denominated one by the effective exchange rate (e).

- p_{IM}: Import Price Index (contact currency basis, 2000 base) by Bank of Japan.
- e: Nominal Effective Exchange Rate Index (2000=100) by Bank of Japan.

3. Data on Financial Conditions of Firms

- $DEBT$: Debt-asset ratio; Total Debt / Total Asset in NEEDS.
- A: Real asset; Total Asset in NEEDS / p.

- $CFLOW$: Cash flow; Ordinary Profit + Depreciation Expense in Manufacturing Statement + Depreciation Expense in Selling and Administrative Expense - Corporate Tax Payment - (Compensation for directors + Transfer from Reserve for Directors' Bonuses + Transfer from Reserve for Directors' retirement benefits) - (Dividends from Retained Earnings + Dividends from Capital Surplus) in NEEDS.
- $SALES$: Sales amount; Sales Amount in NEEDS.
- $LEND$: Bank's Lending Attitudes DI in Quarterly Economic Survey, Bank of Japan.

Table A 1: Descriptive statistics by year: General machinery

	(1) X	(2) Q_E	(3) K	(4) L	(5) M	(6) S_K	(7) S_L	(8) S_M	(9) A	(10) y_E
					mean					
1995	124,767	30,733	73,567	2,679	72,531	0.067	0.255	0.677	181,215	6,685,760
1996	128,487	32,212	73,382	2,557	75,469	0.067	0.251	0.682	181,318	6,838,449
1997	129,445	35,237	77,654	2,604	78,027	0.046	0.259	0.695	186,029	7,418,103
1998	115,629	34,080	78,323	2,504	69,032	0.088	0.270	0.643	180,533	8,145,022
1999	112,417	37,377	78,603	2,376	67,874	0.094	0.260	0.646	181,221	8,153,735
2000	122,207	38,098	79,737	2,286	71,752	0.085	0.243	0.672	185,515	8,352,646
2001	112,657	32,565	80,394	2,187	66,944	0.103	0.255	0.642	176,965	8,520,686
2002	108,333	32,885	78,936	2,055	63,517	0.090	0.257	0.653	172,173	8,475,286
2003	109,939	40,060	79,826	1,993	65,065	0.079	0.242	0.680	182,232	8,364,367
2004	123,755	49,491	82,266	2,004	72,745	0.058	0.234	0.708	190,308	8,627,072
2005	134,707	56,907	87,513	2,088	78,132	0.069	0.226	0.705	211,957	9,019,807
2006	144,541	63,802	89,164	2,067	81,095	0.045	0.220	0.734	223,429	9,386,006
2007	152,011	49,740	86,580	2,679	77,359	0.048	0.219	0.733	221,373	9,594,854
					median					
1995	37,970	8,294	22,921	1,191	22,807	0.059	0.241	0.684	78,580	6,685,760
1996	41,661	8,520	22,573	1,094	23,442	0.058	0.244	0.698	69,132	6,838,449
1997	46,047	9,226	24,770	1,116	25,821	0.037	0.245	0.719	68,087	7,418,103
1998	34,687	7,399	25,815	1,077	21,785	0.071	0.262	0.665	64,327	8,145,022
1999	35,801	6,600	26,259	1,009	19,944	0.072	0.241	0.670	71,878	8,153,735
2000	38,713	7,392	26,093	1,014	22,875	0.077	0.221	0.694	73,498	8,352,646
2001	35,830	7,397	27,443	984	21,212	0.093	0.236	0.662	67,845	8,520,686
2002	38,849	7,927	26,967	941	19,734	0.076	0.246	0.680	65,344	8,475,286
2003	38,115	10,748	27,420	929	22,497	0.069	0.212	0.711	74,097	8,364,367
2004	40,328	10,680	28,689	897	21,750	0.052	0.207	0.740	73,736	8,627,072
2005	47,367	11,694	30,167	954	26,120	0.059	0.207	0.722	78,072	9,019,807
2006	49,484	14,852	30,807	948	26,555	0.032	0.202	0.756	82,344	9,386,006
2007	50,341	15,454	28,723	948	25,815	0.043	0.192	0.757	77,197	9,594,854
					standard deviation					
1995	310,762	85,711	170,243	5,195	175,594	0.041	0.093	0.121	418,482	0
1996	318,216	88,486	174,406	4,979	185,760	0.047	0.094	0.124	427,927	0
1997	309,554	94,306	181,284	4,930	192,229	0.037	0.097	0.118	452,004	0
1998	289,697	93,221	185,399	4,831	181,128	0.100	0.098	0.136	458,740	0
1999	287,789	117,090	185,642	4,680	178,521	0.124	0.096	0.142	455,293	0
2000	309,193	120,772	187,213	4,512	180,082	0.050	0.091	0.120	426,184	0
2001	286,391	94,010	189,210	4,341	172,514	0.062	0.095	0.132	394,835	0
2002	266,015	80,893	191,642	4,162	157,686	0.076	0.095	0.132	377,355	0
2003	247,342	92,372	192,794	4,011	155,193	0.050	0.096	0.116	394,646	0
2004	273,738	115,601	199,620	3,994	172,389	0.040	0.097	0.114	421,739	0
2005	291,435	136,327	207,121	3,984	177,188	0.058	0.096	0.119	463,947	0
2006	316,872	162,380	210,616	3,943	189,308	0.083	0.097	0.121	480,841	0
2007	332,983	79,552	205,339	4,089	148,992	0.033	0.095	0.111	494,121	0

Table A 1: Descriptive statistics by year: General machinery (continued)

	(1) p	(2) p_E	(3) p_W	(4) e	(5) r	(6) p_M	(7) w	(8) wh	(9) $DEBT$	(10) $\log TFP$
					mean					
1995	1.023	1.001	0.994	0.918	0.088	1.030	3,619	2,048	0.543	-0.042
1996	1.016	1.047	1.001	0.801	0.092	1.017	3,741	2,068	0.533	-0.020
1997	1.030	1.065	0.996	0.803	0.059	1.035	3,906	2,054	0.535	-0.022
1998	1.020	1.073	0.996	0.823	0.146	1.020	3,928	1,989	0.513	-0.055
1999	1.007	1.013	1.000	0.953	0.181	1.004	3,899	1,997	0.505	-0.058
2000	0.997	1.013	1.000	1.000	0.106	0.997	4,003	2,043	0.520	-0.015
2001	0.982	1.061	1.001	0.913	0.113	0.976	4,104	2,001	0.514	-0.037
2002	0.969	1.058	0.994	0.909	0.097	0.963	4,155	2,023	0.510	-0.022
2003	0.955	1.024	0.988	0.934	0.089	0.957	4,078	2,063	0.505	0.008
2004	0.952	1.011	1.017	0.956	0.072	0.983	4,119	2,084	0.504	0.049
2005	0.950	1.034	1.036	0.902	0.091	1.006	6,109	2,066	0.480	0.077
2006	0.955	1.053	1.097	0.845	0.096	1.045	4,233	2,066	0.483	0.134
2007	0.961	1.071	1.155	0.824	0.060	1.074	4,199	2,056	0.482	0.140
					median					
1995	1.023	1.001	0.994	0.918	0.086	1.030	3,583	2,048	0.554	-0.050
1996	1.016	1.047	1.001	0.801	0.086	1.017	3,700	2,068	0.551	-0.038
1997	1.030	1.065	0.996	0.803	0.055	1.035	3,814	2,054	0.539	-0.037
1998	1.020	1.073	0.996	0.823	0.090	1.020	3,847	1,989	0.522	-0.060
1999	1.007	1.013	1.000	0.953	0.085	1.004	3,897	1,997	0.528	-0.052
2000	0.997	1.013	1.000	1.000	0.097	0.997	3,984	2,043	0.552	-0.031
2001	0.982	1.061	1.001	0.913	0.106	0.976	3,981	2,001	0.572	-0.056
2002	0.969	1.058	0.994	0.909	0.084	0.963	3,963	2,023	0.578	-0.027
2003	0.955	1.024	0.988	0.934	0.083	0.957	4,196	2,063	0.553	-0.003
2004	0.952	1.011	1.017	0.956	0.062	0.983	4,071	2,084	0.538	0.038
2005	0.950	1.034	1.036	0.902	0.075	1.006	4,285	2,066	0.496	0.067
2006	0.955	1.053	1.097	0.845	0.041	1.045	4,284	2,066	0.521	0.100
2007	0.961	1.071	1.155	0.824	0.059	1.074	4,246	2,056	0.501	0.132
					standard deviation					
1995	0	0	0	0	0.014	0	580	0	0.200	0.129
1996	0	0	0	0	0.036	0	584	0	0.199	0.119
1997	0	0	0	0	0.017	0	664	0	0.198	0.105
1998	0	0	0	0	0.451	0	696	0	0.212	0.138
1999	0	0	0	0	0.669	0	686	0	0.205	0.158
2000	0	0	0	0	0.032	0	701	0	0.199	0.127
2001	0	0	0	0	0.040	0	746	0	0.208	0.124
2002	0	0	0	0	0.081	0	1,075	0	0.210	0.125
2003	0	0	0	0	0.039	0	756	0	0.194	0.109
2004	0	0	0	0	0.067	0	686	0	0.185	0.111
2005	0	0	0	0	0.127	0	16,819	0	0.184	0.135
2006	0	0	0	0	0.472	0	790	0	0.169	0.271
2007	0	0	0	0	0.010	0	766	0	0.169	0.153

Table A 2: Descriptive statistics by year: Electrical machinery

	(1) X	(2) Q_E	(3) K	(4) L	(5) M	(6) S_K	(7) S_L	(8) S_M	(9) A	(10) y_E
					mean					
1995	227,951	83,442	158,600	5,992	134,179	0.099	0.268	0.633	306,555	6,153,726
1996	255,626	87,858	159,865	5,662	147,555	0.091	0.271	0.639	330,560	6,275,560
1997	274,898	100,961	172,259	5,738	154,809	0.084	0.270	0.646	362,088	6,637,265
1998	259,119	96,452	170,572	5,430	146,380	0.121	0.267	0.612	363,933	7,120,295
1999	277,342	109,490	169,276	5,255	157,052	0.144	0.244	0.612	381,219	7,483,476
2000	326,175	101,777	175,311	5,166	180,821	0.122	0.241	0.637	426,240	7,730,663
2001	297,066	87,028	177,307	4,812	158,024	0.158	0.258	0.584	440,498	7,641,197
2002	309,549	109,714	168,019	4,527	157,278	0.146	0.252	0.602	467,952	7,606,641
2003	321,926	135,300	153,065	4,243	161,255	0.157	0.253	0.591	508,205	7,729,519
2004	364,314	170,132	163,826	4,291	177,906	0.129	0.252	0.620	545,217	7,989,945
2005	404,678	214,804	167,201	4,299	191,522	0.095	0.266	0.639	577,868	8,208,511
2006	450,592	260,354	176,534	4,381	206,266	0.098	0.265	0.637	626,445	8,476,611
2007	487,812	277,515	167,708	4,498	218,275	0.121	0.254	0.625	659,603	8,959,611
					median					
1995	50,084	14,743	35,502	1,711	31,370	0.083	0.247	0.657	75,117	6,153,726
1996	61,781	15,450	33,679	1,636	33,870	0.076	0.255	0.669	82,080	6,275,560
1997	68,808	18,091	36,401	1,624	33,986	0.067	0.254	0.676	86,092	6,637,265
1998	60,311	13,950	34,413	1,523	33,866	0.097	0.251	0.650	86,235	7,120,295
1999	60,035	20,175	34,547	1,467	36,337	0.113	0.235	0.651	90,386	7,483,476
2000	66,842	18,842	36,157	1,465	40,289	0.095	0.230	0.673	93,860	7,730,663
2001	60,172	18,315	35,885	1,354	33,661	0.122	0.241	0.638	94,766	7,641,197
2002	63,417	20,950	34,693	1,312	33,779	0.123	0.230	0.648	104,236	7,606,641
2003	65,595	28,093	32,659	1,177	34,676	0.122	0.233	0.644	106,225	7,729,519
2004	84,369	32,020	35,778	1,186	38,642	0.092	0.231	0.675	119,391	7,989,945
2005	86,739	41,312	37,496	1,228	41,972	0.076	0.237	0.678	137,443	8,208,511
2006	90,541	47,206	37,857	1,240	43,997	0.069	0.235	0.680	141,996	8,476,611
2007	96,767	52,205	37,938	1,297	43,170	0.094	0.235	0.668	148,777	8,959,611
					standard deviation					
1995	573,599	209,644	392,958	13,371	331,517	0.052	0.113	0.145	700,964	0
1996	655,282	223,126	403,509	12,730	378,646	0.052	0.118	0.150	758,282	0
1997	675,760	246,478	422,839	12,506	378,334	0.082	0.123	0.157	807,475	0
1998	648,577	234,657	419,913	11,824	362,917	0.103	0.124	0.164	823,402	0
1999	685,941	267,718	410,115	11,192	387,377	0.121	0.118	0.166	857,561	0
2000	799,013	232,483	419,604	10,672	448,326	0.130	0.124	0.174	936,937	0
2001	737,974	203,716	428,343	10,048	396,643	0.145	0.127	0.185	985,036	0
2002	722,948	282,023	391,465	9,316	375,904	0.116	0.103	0.165	1,051,463	0
2003	734,998	330,654	349,819	8,661	395,547	0.127	0.114	0.177	1,140,790	0
2004	790,679	394,546	364,433	8,451	414,135	0.142	0.143	0.200	1,168,746	0
2005	906,948	483,165	377,505	8,549	467,126	0.082	0.157	0.189	1,238,529	0
2006	1,020,956	575,114	396,763	8,498	520,050	0.113	0.168	0.204	1,294,474	0
2007	1,123,143	622,074	373,731	8,250	571,037	0.099	0.140	0.183	1,365,257	0

Table A 2: Descriptive statistics by year: Electrical machinery (continued)

	(1) p	(2) p_E	(3) p_W	(4) e	(5) r	(6) p_M	(7) w	(8) wh	(9) $DEBT$	(10) $\log TFP$
					mean					
1995	1.237	1.217	1.282	0.918	0.131	1.138	3,755	1,917	0.520	-0.063
1996	1.137	1.211	1.190	0.801	0.117	1.086	3,931	1,915	0.503	0.017
1997	1.098	1.207	1.152	0.803	0.125	1.079	4,055	1,914	0.491	0.057
1998	1.056	1.191	1.109	0.823	0.182	1.048	4,071	1,874	0.492	0.042
1999	1.028	1.058	1.081	0.953	0.267	1.014	4,000	1,891	0.499	0.056
2000	0.977	1.004	1.000	1.000	0.452	0.988	4,164	1,911	0.511	0.132
2001	0.886	0.995	0.856	0.913	0.303	0.928	4,245	1,861	0.493	0.133
2002	0.821	0.892	0.775	0.909	0.195	0.881	4,296	1,901	0.497	0.185
2003	0.770	0.803	0.724	0.934	0.199	0.854	5,346	1,936	0.493	0.263
2004	0.736	0.749	0.692	0.956	0.424	0.851	4,509	1,928	0.483	0.339
2005	0.709	0.730	0.641	0.902	0.100	0.853	4,447	1,927	0.477	0.419
2006	0.693	0.724	0.619	0.845	0.136	0.891	4,378	1,941	0.479	0.497
2007	0.682	0.721	0.604	0.824	0.138	0.901	4,307	1,937	0.483	0.508
					median					
1995	1.237	1.217	1.282	0.918	0.128	1.138	3,817	1,917	0.517	-0.122
1996	1.137	1.211	1.190	0.801	0.113	1.086	3,980	1,915	0.500	-0.048
1997	1.098	1.207	1.152	0.803	0.093	1.079	4,124	1,914	0.495	-0.007
1998	1.056	1.191	1.109	0.823	0.129	1.048	4,117	1,874	0.478	-0.016
1999	1.028	1.058	1.081	0.953	0.162	1.014	4,034	1,891	0.481	0.003
2000	0.977	1.004	1.000	1.000	0.134	0.988	4,261	1,911	0.498	0.056
2001	0.886	0.995	0.856	0.913	0.155	0.928	4,192	1,861	0.481	0.076
2002	0.821	0.892	0.775	0.909	0.153	0.881	4,284	1,901	0.494	0.134
2003	0.770	0.803	0.724	0.934	0.167	0.854	4,409	1,936	0.498	0.213
2004	0.736	0.749	0.692	0.956	0.120	0.851	4,362	1,928	0.473	0.271
2005	0.709	0.730	0.641	0.902	0.095	0.853	4,334	1,927	0.475	0.328
2006	0.693	0.724	0.619	0.845	0.085	0.891	4,332	1,941	0.464	0.395
2007	0.682	0.721	0.604	0.824	0.128	0.901	4,270	1,937	0.469	0.418
					standard deviation					
1995	0	0	0	0	0.023	0	631	0	0.184	0.303
1996	0	0	0	0	0.021	0	671	0	0.193	0.295
1997	0	0	0	0	0.274	0	721	0	0.190	0.309
1998	0	0	0	0	0.406	0	724	0	0.199	0.290
1999	0	0	0	0	0.803	0	741	0	0.189	0.265
2000	0	0	0	0	2.806	0	834	0	0.187	0.320
2001	0	0	0	0	1.051	0	914	0	0.211	0.290
2002	0	0	0	0	0.323	0	848	0	0.201	0.233
2003	0	0	0	0	0.207	0	9,244	0	0.180	0.287
2004	0	0	0	0	2.789	0	1,717	0	0.184	0.339
2005	0	0	0	0	0.019	0	1,447	0	0.171	0.420
2006	0	0	0	0	0.424	0	1,095	0	0.177	0.504
2007	0	0	0	0	0.048	0	933	0	0.174	0.384

Table A 3: Descriptive statistics by year: Transportation equipment

	(1) X	(2) Q_E	(3) K	(4) L	(5) M	(6) S_K	(7) S_L	(8) S_M	(9) A	(10) y_E
					mean					
1995	394,748	152,998	240,153	6,766	292,844	0.083	0.199	0.718	306,204	6,629,682
1996	621,150	222,199	340,378	8,622	457,051	0.069	0.198	0.733	484,600	6,895,902
1997	594,722	246,293	352,881	8,532	426,757	0.060	0.205	0.736	490,819	7,287,755
1998	546,056	229,792	349,846	8,191	389,226	0.086	0.203	0.711	485,673	7,972,730
1999	542,454	245,216	349,015	7,869	391,930	0.094	0.191	0.715	516,758	8,630,374
2000	569,066	268,657	349,128	7,645	410,135	0.097	0.188	0.715	578,243	8,879,758
2001	599,240	281,529	350,396	7,355	418,363	0.093	0.190	0.717	597,006	9,031,915
2002	649,647	323,005	342,925	6,969	456,615	0.093	0.183	0.724	599,946	9,083,276
2003	670,409	356,813	349,705	6,908	470,116	0.072	0.186	0.742	637,186	8,991,444
2004	708,698	407,140	360,671	6,908	492,948	0.067	0.177	0.756	680,670	8,964,112
2005	778,495	469,540	372,372	6,996	532,968	0.052	0.173	0.775	744,690	9,146,672
2006	895,851	596,268	409,339	7,453	603,572	0.045	0.166	0.789	845,353	9,453,186
2007	933,762	697,763	384,476	7,491	622,505	0.039	0.161	0.800	812,645	9,026,056
					median					
1995	114,395	12,454	88,968	2,984	73,109	0.075	0.190	0.734	109,484	6,629,682
1996	131,086	11,683	98,631	3,248	85,761	0.059	0.188	0.745	134,634	6,895,902
1997	143,126	12,373	101,990	3,544	86,020	0.053	0.198	0.745	126,298	7,287,755
1998	113,045	12,191	105,205	2,961	75,498	0.079	0.194	0.727	123,800	7,972,730
1999	121,988	11,190	103,821	2,850	70,788	0.083	0.178	0.723	137,319	8,630,374
2000	130,232	14,888	106,154	2,726	72,612	0.083	0.180	0.729	137,911	8,879,758
2001	117,773	19,132	107,277	2,636	71,011	0.081	0.178	0.722	135,968	9,031,915
2002	128,338	22,041	109,959	2,639	81,567	0.078	0.167	0.736	133,682	9,083,276
2003	139,801	30,594	112,600	2,631	90,051	0.059	0.177	0.759	134,350	8,991,444
2004	157,991	35,945	115,022	2,620	96,089	0.047	0.161	0.785	140,277	8,964,112
2005	167,656	44,486	118,841	2,671	101,729	0.037	0.161	0.785	146,294	9,146,672
2006	179,926	84,145	159,874	2,726	99,648	0.034	0.150	0.800	201,066	9,453,186
2007	174,698	186,124	139,197	2,572	107,315	0.029	0.156	0.813	160,945	9,026,056
					standard deviation					
1995	673,440	319,850	394,311	8,966	525,129	0.032	0.075	0.098	539,206	0
1996	1,369,153	511,339	643,076	12,955	1,049,488	0.028	0.077	0.099	1,089,556	0
1997	1,210,784	582,734	666,568	12,748	887,447	0.024	0.080	0.097	1,094,854	0
1998	1,152,374	574,590	666,159	12,404	837,544	0.033	0.075	0.100	1,108,697	0
1999	1,124,872	638,422	656,488	11,737	833,770	0.036	0.075	0.103	1,182,124	0
2000	1,203,707	702,736	647,182	11,591	892,552	0.037	0.074	0.101	1,283,337	0
2001	1,294,641	750,237	645,689	11,369	912,181	0.042	0.076	0.106	1,345,881	0
2002	1,405,335	862,342	633,907	11,076	993,564	0.055	0.080	0.119	1,383,713	0
2003	1,448,745	873,955	648,158	11,035	1,026,091	0.046	0.085	0.118	1,451,426	0
2004	1,550,266	948,457	667,118	11,124	1,091,500	0.081	0.085	0.128	1,532,432	0
2005	1,717,164	1,094,068	678,761	11,294	1,187,155	0.051	0.082	0.109	1,677,990	0
2006	1,969,557	1,355,891	733,356	11,986	1,330,614	0.034	0.088	0.114	1,860,337	0
2007	2,048,413	1,477,070	689,852	12,153	1,387,340	0.033	0.091	0.116	1,798,011	0

Table A 3: Descriptive statistics by year: Transportation equipment (continued)

	(1) p	(2) p_E	(3) p_W	(4) e	(5) r	(6) p_M	(7) w	(8) wh	(9) $DEBT$	(10) $\log TFP$
					mean					
1995	1.035	1.039	0.986	0.918	0.108	1.038	3,581	1,992	0.597	-0.026
1996	1.019	1.145	0.996	0.801	0.088	1.022	3,771	2,016	0.594	-0.005
1997	1.026	1.174	1.007	0.803	0.072	1.031	3,858	2,022	0.577	0.002
1998	1.019	1.207	1.006	0.823	0.098	1.019	3,870	1,966	0.583	-0.012
1999	1.010	1.067	1.003	0.953	0.108	1.007	3,808	1,979	0.582	-0.003
2000	0.995	1.005	1.000	1.000	0.110	0.996	3,959	2,014	0.579	0.013
2001	0.972	1.072	0.988	0.913	0.103	0.977	4,246	1,984	0.577	0.041
2002	0.954	1.092	0.993	0.909	0.104	0.958	4,312	2,033	0.576	0.061
2003	0.938	1.122	1.013	0.934	0.079	0.944	4,404	2,050	0.560	0.074
2004	0.928	1.092	1.022	0.956	0.094	0.947	4,328	2,054	0.548	0.088
2005	0.923	1.121	1.027	0.902	0.081	0.962	4,316	2,071	0.542	0.105
2006	0.922	1.162	1.029	0.845	0.052	0.986	4,316	2,083	0.566	0.121
2007	0.923	1.179	1.030	0.824	0.047	1.004	4,354	2,066	0.568	0.160
					median					
1995	1.035	1.039	0.986	0.918	0.108	1.038	3,481	1,992	0.598	-0.029
1996	1.019	1.145	0.996	0.801	0.087	1.022	3,711	2,016	0.586	-0.009
1997	1.026	1.174	1.007	0.803	0.069	1.031	3,763	2,022	0.582	-0.014
1998	1.019	1.207	1.006	0.823	0.098	1.019	3,714	1,966	0.595	-0.030
1999	1.010	1.067	1.003	0.953	0.108	1.007	3,703	1,979	0.603	-0.025
2000	0.995	1.005	1.000	1.000	0.110	0.996	3,813	2,014	0.590	0.001
2001	0.972	1.072	0.988	0.913	0.102	0.977	3,989	1,984	0.558	0.023
2002	0.954	1.092	0.993	0.909	0.101	0.958	4,195	2,033	0.548	0.039
2003	0.938	1.122	1.013	0.934	0.078	0.944	4,337	2,050	0.551	0.060
2004	0.928	1.092	1.022	0.956	0.060	0.947	4,260	2,054	0.533	0.071
2005	0.923	1.121	1.027	0.902	0.050	0.962	4,322	2,071	0.525	0.083
2006	0.922	1.162	1.029	0.845	0.049	0.986	4,311	2,083	0.571	0.097
2007	0.923	1.179	1.030	0.824	0.045	1.004	4,509	2,066	0.571	0.116
					standard deviation					
1995	0	0	0	0	0.009	0	410	0	0.136	0.060
1996	0	0	0	0	0.011	0	445	0	0.129	0.055
1997	0	0	0	0	0.012	0	506	0	0.138	0.096
1998	0	0	0	0	0.010	0	560	0	0.150	0.106
1999	0	0	0	0	0.008	0	594	0	0.153	0.113
2000	0	0	0	0	0.007	0	646	0	0.155	0.101
2001	0	0	0	0	0.007	0	961	0	0.156	0.105
2002	0	0	0	0	0.012	0	664	0	0.155	0.114
2003	0	0	0	0	0.009	0	627	0	0.154	0.099
2004	0	0	0	0	0.230	0	691	0	0.141	0.099
2005	0	0	0	0	0.209	0	679	0	0.135	0.101
2006	0	0	0	0	0.012	0	682	0	0.125	0.099
2007	0	0	0	0	0.011	0	856	0	0.126	0.125

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