RIETI Discussion Paper Series 16-E-034

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http://www.rieti.go.jp/en/

RIETI Discussion Paper Series 16-E-034

March 2016

Exchange Rate Pass-through in Production Chains: Application of input-output analysis[*]

Huong Le Thu HOANG[†] and SATO Kiyotaka[‡]

Abstract

This study proposes a new empirical approach to the exchange rate pass-through (ERPT) in Japanese imports using input-output (IO) analysis. We analyze how exchange rate changes are transmitted from import prices to domestic producer prices through numerous stages of production by employing the Japanese IO tables of 2000, 2005, and 2011. Specifically, calculating input coefficients among 108 industries at numerous production stages, we demonstrate that, contrary to the stylized fact, the extent of ERPT to domestic producer prices should be significantly higher than empirical results of the conventional ERPT analysis. Conducting a panel estimation of ERPT determinants, we show that a large dependence on intermediate input imports tends to increase the extent of ERPT. More importantly, we reveal that if the manufacturing sectors tend not only to import intermediate inputs from abroad but also to export their products to foreign countries, the degree of import pass-through to producer prices increases significantly. Thus, growing international production sharing will have a positive impact on ERPT to domestic producer prices.

Keywords: Exchange rate pass-through, Input-Output table, Production chain, Japanese imports, Producer prices, Invoice currency, International production network

JEL classification: E31, F31, F41

[*]This study is conducted as a part of the Project "Exchange Rates and International Currency" undertaken at Research Institute of Economy, Trade and Industry (RIETI). The authors are grateful for helpful comments and suggestions by Discussion Paper seminar participants at RIETI. The authors would also appreciate the financial support of the JSPS (Japan Society for the Promotion of Science) Grant-in-Aid for Scientific Research (A) No. 24243041 and (B) No. 24330101. We wish to thank Etsuro Shioji, Eiji Ogawa, Taisuke Uchino, Willem Thorbecke, and Junko Shimizu for their valuable comments.

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1 Introduction

Japanese economy has experienced a large and rapid change of the exchange rate since the mid-2000s. Japanese yen started to appreciate from around 120 yen vis-à-vis the U.S. dollar in mid-2007 and accelerated the pace of yen appreciation in 2008 when the Lehman Brothers collapsed. The yen hit 75.32 yen vis-à-vis the U.S. dollar, the post-war record high, in October 2011 when the Euro area fiscal crisis became more serious. From the end of 2012, however, the yen started to depreciate dramatically thanks to the Prime Minister Abe's economic stimulus package, so-called *Abenomics*. From the end of 2012 to the end of 2014, the yen depreciated against the U.S. dollar by more than 50 percent, but Japanese economy has suffered from the prolonged deflation.[1] Figure 1 presents the annual average data on the yen/U.S. dollar nominal exchange rate, Japanese import price index and producer price index from 2012 to 2014, which clearly shows that domestic producer prices are far less responsive to nominal exchange rate changes than import prices. Why has the large depreciation of the yen failed to cause an increase in domestic producer prices?

To measure the extent of price changes in response to exchange rate changes, we typically rely on the exchange rate pass-through (ERPT) approach. There have been a large number of empirical studies on the extent of ERPT into import prices and domestic prices. Stylized facts show that import prices are the most responsive to exchange rate changes, while domestic consumer prices are the least responsive to exchange rates.[2] Domestic producer prices are also typically less responsive to exchange rate changes than import prices.

The existing studies generally used a single equation model of ERPT to analyze the domestic price sensitivity to exchange rates (Campa and Goldberg, 2005; Otani *et al.*, 2003). But, the single equation approach can only consider a

1 The data of the yen-U.S. dollar exchange rates are taken from the CEIC Database.

2 See, for instance, Goldberg and Campa (2005), Choudhri *et al*. (2005) and Ito and Sato (2008) for the degree of responsiveness of different domestic prices to exchange rate changes.

direct relationship between domestic price and exchange rate variables, and fails to capture the transmission of exchange rate changes from upstream to downstream production prices. A vector autoregressive (VAR) model has also been widely used to investigate interactions between exchange rate and price variables. Choudhri *et al*. (2005) used the VAR analysis of ERPT to different prices for non-U.S. G-7 countries. Ito and Sato (2008) conducted the VAR analysis of ERPT for Asian countries that experienced the currency crisis in 1997-98 by including import price, producer price, and consumer price variables in the VAR model. In recent years, Shioji (2014, 2015) applied the time-varying VAR technique to the ERPT analysis to explore possible changes in the degree of ERPT to Japanese consumer prices.[3] Indeed a VAR approach is useful in examining the interactions between different price variables, but this approach cannot fully investigate the transmission from exchange rate changes to domestic price inflation through numerous production stages.

This study proposes a new approach to ERPT along production chains by using an Input-Output (IO) table. Specifically, we analyze how exchange rate changes are transmitted from import prices to domestic producer prices through numerous stages of production by employing the Japanese IO tables of 2000, 2005, and 2011. There have been only a few studies that applied an IO analysis to the ERPT question. One exception is Shioji and Uchino (2010) that examined the effect of an oil price increase on consumer goods prices of selected industries. Goldberg and Campa (2005) and Hara *et al*. (2015) also used the information from IO tables for their analysis of ERPT.

A novelty of this paper is to develop a new empirical approach to ERPT analysis by utilizing the detailed information on domestic and international production linkages obtained from IO tables. We employ the following two-stage approach. First, we estimate the single-equation model to estimate the degree of ERPT to import prices. We use the state-space model to estimate the time-varying

[3] For the recent application of the time-varying parameter estimation to the ERPT analysis, see Hara *et al*. (2015).

ERPT into import price of intermediate input goods. Second, using input coefficients obtained from IO tables, we analyze how the ERPT effect is transmitted from import prices to domestic producer prices through numerous production stages at different industries. We compare the results of our two-stage approach with those of the conventional single-equation model. Furthermore, we conduct a panel estimation to examine the determinants of ERPT to domestic producer prices.

To anticipate the results, our two-stage ERPT estimation demonstrates that growing domestic and production linkages in Japan have facilitated the transmission of exchange rate changes to domestic producer prices. The estimated ERPT coefficients obtained from the two-stage approach are positive and statistically significant in most cases, which contrast markedly with the insignificant ERPT coefficients obtained from the conventional approach. More importantly, by the fixed effect panel estimation, we reveal that if manufacturing sectors tend not only to import intermediate inputs from abroad but also to export their products to foreign countries, the degree of import pass-through to producer prices increases significantly. Thus, growing international production sharing will have a positive impact on ERPT to domestic producer prices.

The rest of the paper is organized as follows. Section 2 presents the empirical methods for an IO analysis of ERPT. Section 3 shows the empirical results of ERPT to domestic producer prices. Section 4 analyzes the determinants of ERPT. Finally, Section 5 concludes this study.

2 Empirical Methods

This study proposes a new approach to ERPT to domestic producer prices by using an IO table. We employ the following two-step approach to investigate the ERPT along production chains.

2.1 First Stage Estimation: State-Space Analysis of Import Pass-Through

State Space Estimation

We start the ERPT analysis by investigating the extent of pass-through from exchange rate changes to Japanese import prices. We extend the conventional import pass-through model proposed by Campa and Goldberg (2005) to the state-space model. We use the following observation and state equations, respectively, to estimate time-varying parameters:

$$\Delta \ln P_t^m = \beta_{0,t} + \beta_{1,t} \Delta \ln NEER_t + \beta_{2,t} \Delta \ln P_t^W + \beta_{3,t} \Delta \ln Y_t^{JP} + \varepsilon_t , \qquad (1)$$

and

$$\beta_{k,t} = \beta_{k,t-1} + \upsilon_{k,t} \quad \text{for } k = 0, 1, 2 \text{ and } 3, \qquad (2)$$

where P_t^m denotes the import price; $NEER_t$ denotes the nominal effective exchange rate; P_t^W denotes the world producer price as a proxy for the weighted average of exporting countries' production costs; Y_t^{JP} denotes the Japanese industrial production index as a proxy for Japanese real output; ε_t and υ_t denote the Gaussian disturbances with zero mean; β_t is assumed to follow a random walk process; and Δ denotes the first-difference operator.

To better capture the effect of exchange rate changes on import prices, we focus on the short-run response of import prices to the exchange rate changes. Campa and Goldberg (2005) and other previous studies typically include lagged exchange rate variables to allow for gradual changes of import price itself in response to the exchange rate change. Indeed, ERPT covers not only a short-run price response but also medium-run price revisions by exporting firms. However, our main interest is in the direct effect of exchange rate changes on import prices and, hence, only contemporaneous exchange rate is included in the right-hand side of equation (1).

We use the state-space model to estimate the time-varying parameter of import pass-through coefficient, β_t, in equation (1) for the sample period from January 2000 to May 2012.[4] Following Kim and Nelson (1999), we obtain the maximum likelihood estimator of β_t as an initial value of time-varying coefficients using the sub-sample from 2000 to 2004. With the estimated initial value, we use the Kalman filter technique to estimate the time-varying coefficients.

Contract Currency Based NEER

To make rigorous estimation of ERPT, we use the "contract currency based NEER", first proposed by Ceglowski (2010) and developed by Shimizu and Sato (2015) and Nguyen and Sato (2015). Conventional NEER published by Bank for International Settlements (BIS) and International Monetary Fund (IMF) is calculated as a *trade* weighted average of bilateral nominal exchange rates. As of 2014, the share of Japan's imports from the United States in the total imports is just 9.0 percent, while 64.5 percent of Japan's imports are from emerging and developing countries.[5] However, according to the Japanese Ministry of Finance, 69.8 percent of Japan's imports are invoiced in U.S. dollars, and the share of the yen accounts for just 23.8 percent of Japan's total imports in the second-half of 2015.[6] Since the third currency invoicing is very large in Japanese imports, it is not the trade-weighted NEER but the *contract currency* based NEER (henceforth,

[4] We use the 2005 base year import price index provided by BOJ so that we can estimate the time-varying coefficients of 2000, 2005, and 2011 using the consistent series of price data. It is in fact better to start the sample period from the 1990s, because we need to estimate the initial values for time varying estimation. However, as long as using the 2005 base year price index, we can use the data spanning from January 2000 to May 2012 only. Thus, we need to carefully interpret the result of time varying parameter estimation.

[5] Japan's trade share is computed from the data provided by IMF, *Direction of Trade Statistics*.

[6] For the data on the invoice currency share of Japanese trade, see the website of the Ministry of Finance (http://www.customs.go.jp/toukei/shinbun/trade-st/tuuka.htm). The share of U.S. dollar invoicing in Japan's total imports was 70.7 percent in 2000, 72.1 percent in 2005, and 72.4 percent in 2011.

contract-NEER) that better reflects the ERPT of Japanese imports at the customs clearance stage. Since BOJ does not publish the source country breakdown data on import prices, the contract-NEER enables us to capture the weighted average of source country specific pass-through based on the exchange rate of the yen vis-à-vis the contract currency.

Suppose only three currencies are used in Japanese imports: the yen, the U.S. dollar, and the Euro.[7] Import price indices on a contract currency basis (P_{con}^{IM}) and on a yen basis (P_{yen}^{IM}) can be expressed as follows:[8]

$$P_{con}^{IM} = \left(P_{yen}\right)^{\alpha}\left(P_{usd}\right)^{\beta}\left(P_{eur}\right)^{\gamma} \tag{3}$$

and

$$P_{yen}^{IM} = \left(P_{yen}\right)^{\alpha}\left(E_{yen/usd}P_{usd}\right)^{\beta}\left(E_{yen/eur}P_{eur}\right)^{\gamma}. \tag{4}$$

BOJ collects the information on the choice of contract (invoice) currency when making survey with Japanese importers at a port level. BOJ first constructs import price indices on a contract currency basis, and then converts them into the import price indices on a yen basis using the nominal exchange rate of the yen vis-à-vis the contract currency k ($E_{yen/k}$). Dividing equation (4) by equation (3), we obtain the following formula of the contract-NEER:

$$NEER_{yen}^{Contract} = \frac{P_{yen}^{IM}}{P_{con}^{IM}} = \left(E_{yen/usd}\right)^{\beta}\left(E_{yen/eur}\right)^{\gamma}. \tag{5}$$

The above discussion based on the three contract (invoice) currencies can be generalized to the case of four or more contract currencies.[9] The contract-NEER used in this study reflects the choice of minor currencies as an invoice currency.

[7] The following explanation is based on Nguyen and Sato (2015).
[8] By definition, the sum of the weights in respective equations (3) and (4) is assumed to be unity.
[9] See Nguyen and Sato (2015) for further details.

Moreover, since the industry- or commodity-breakdown data of BOJ import prices are available on both yen basis and contract currency basis, we can calculate the *sector* breakdown data of contract-NEER as well. Thus, in contrast to the previous studies, we investigate the ERPT effect of different NEERs on import prices.

Control Variables

To measure the trading partners' production costs for Japanese imports, we need to calculate a weighted average of exporting countries' producer price indices (P_t^W). Following Campa and Goldberg (2005), we collect the effective exchange rates of the yen in both nominal and real terms from BIS, and use the following formula to obtain the trading partners' production costs:

$$P_t^W = \left(\frac{NEER_t^{yen}}{REER_t^{yen}} \right) \cdot P_t^{JP} = \Pi_{k=1}^{n} (P_t^k)^{\alpha_k}, \qquad (6)$$

where P_t^{JP} denotes the Japanese producer price index (PPI); P_t^k denotes the k-th trading partner country's PPI; α_k denotes the share of Japanese imports from k-th country in the total imports; and $\sum_{k=1}^{n} \alpha_k = 1$.

For Japanese real output, we use the monthly series of Japanese industrial production index that was collected from Ministry of Economy, Trade and Industry (METI), Japan.

2.2 Second Stage Estimation: Input-Output Analysis of Pass-Through to Producer Prices

The second-stage estimation of ERPT considers the transmission of changes in imported intermediate input prices (expressed in domestic currency terms) to domestic producer prices. Applying the IO price analysis, we derive the equation of ERPT from import prices to domestic producer prices. The details of derivation are addressed in Appendix.[10]

Domestic producer price vector can be expressed by the following equation:

$$\mathbf{P^d} = \left(\mathbf{P^m A^m} + \mathbf{v}\right)(\mathbf{I} - \mathbf{A^d})^{-1}, \qquad (7)$$

where $\mathbf{P^d}$ is a row vector of domestic producer prices (endogenous variables), and $\mathbf{P^m}$ is a row vector of imported intermediate prices (exogenous variables), $\mathbf{A^d}$ is a matrix of domestic intermediate input coefficients, $\mathbf{A^m}$ is a matrix of imported intermediate input coefficients, $\mathbf{v}$ is a row vector of value added.

Assuming no changes in the value added vector and the domestic intermediate input coefficients, we can calculate the change of domestic producer prices vector ($\Delta\mathbf{P^d}$) in response to the change of imported intermediate prices ($\Delta\mathbf{P^m}$):

$$\Delta\mathbf{P^d} = \Delta\mathbf{P^m A^m}(\mathbf{I} - \mathbf{A^d})^{-1}. \qquad (8)$$

At the first stage estimation, we obtained the time-varying ERPT coefficient, $\beta_{1,t}$, that reflects the extent of changes in imported intermediate prices in response to one percent change in NEER.[11] We substitute an annual average of the estimated coefficient, $\beta_{1,t}$, for 2000, 2005, and 2011 into $\Delta\mathbf{P^m}$ in equation (8), which enables us to measure $\Delta\mathbf{P^d}$, a change in the domestic producer prices in response to one percent change (depreciation) in NEER in respective years.[12]

[10] See also Appendix Table 1 for the list of IO classification (108 industries).
[11] Since BOJ does not publish the price data of service imports, we could not estimate the time varying parameter estimation of Japanese service imports.
[12] Under the IO framework where Leontief production function is assumed, elasticity of substitution is

3 Empirical Results of Exchange Rate Pass-Through

3.1 Exchange Rate Pass-Through to Import Prices

Let us first look at the estimated results of the first stage estimation, i.e., changes in ERPT to import prices over time. We took an arithmetic average of time-varying ERPT coefficients ($\beta_{1,t}$) for each industry in 2000, 2005, and 2011, which are reported in Table 1. Overall, the degree of ERPT to import prices is close to unity and statistically significant in most cases. Our estimated results show higher ERPT than those of previous studies such as Otani *et al*. (2003), which is likely due to the difference in NEER. We use the contract-NEER that fully reflects the share of invoice currency in Japanese imports, while existing studies typically use the conventional NEER that is constructed using the trade weight and, hence, fail to take into consideration the large share of U.S. dollar invoicing in Japanese imports.

3.2 Exchange Rate Pass-Through to Producer Prices

Table 2 presents the results of ERPT to domestic producer prices by the two stage estimation approach. For comparison purpose, we also estimated the ERPT coefficients using the conventional single-equation model, and the results are reported in the left-hand side of Table 2. Specifically, we conducted the state-space estimation of the single-equation model by using producer price indices in the left-hand side and the contract-NEER in the right-hand side of equation (1). An arithmetic average of time-varying ERPT coefficients in 2000, 2005, and 2011 is reported in Table 2.

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equal to zero. Despite this limitation, it is useful to use the detailed information on domestic and international production linkages obtained from IO tables.

First, the estimated ERPT coefficients obtained from the two stage estimation approach are positive and statistically significant in most industries.[13] In contrast, the estimated ERPT coefficients obtained from the conventional single-equation model are not statistically significant at all except for just one industry in 2000. Second, if comparing the two estimated results, the degree of ERPT coefficients obtained from the two stage estimation approach are generally much higher. The ERPT coefficients obtained from the conventional single-equation model are quite small and insignificant in most cases. Third, in the case of two stage estimation approach, the estimated ERPT coefficients increase gradually from 2000 to 2011. This finding suggests that the degree of import pass-through to domestic producer prices becomes significantly higher if taking into account the transmission of exchange rate impact through production chains.

3.3 Effect of Import Price Changes on Producer Prices

We have so far discussed the degree of exchange rate transmission to domestic producer prices. But, the import price itself can increase or decrease irrespective of the nominal exchange rate changes. In this sub-section, assuming no exchange rate changes, we attempt to analyze the impact of a change in import price itself on producer prices of other industries.

We conducted a simulation analysis assuming that the import price of only one sector, "coal mining, crude petroleum and natural gas," changes by one percent. Figure 2 shows the effect of one percent price increase of the above sector on producer prices of various sectors. It is found that energy related products and some service sectors including electricity and gas and heat supply are the most responsive to one percent increase in oil price. In contrast, most machinery sectors tend to be far less responsive to the price increase of the above sector. The detailed

[13] To obtain the significance level of the second stage estimation, we use the information on the error-confidence band (±2 standard error) of the first stage estimation. We conducted the second stage estimation by using the lower error confidence band obtained from the first stage estimation. If the estimated result is larger than zero, the estimated ERPT coefficients are regarded as statistically significant.

results of estimation are presented in Appendix Table 2.

From the latter half of 2014, crude oil price started to decline substantially. In Figure 3, we present the additional simulation results of price changes in machinery sectors in response to a sharp decline in oil prices by 50 percent.[14] Japanese major machinery sectors exhibit a decline in producer prices only by 1.0-1.8 percent in response to 50 percent fall in oil prices.

4 Determinants of Exchange Rate Pass-Through

4.1 Empirical Model

We have so far analyzed the ERPT to domestic producer prices in Japanese imports by using the two stage approach. In this section, we also empirically investigate the determinants of ERPT along both domestic and international production chains. We set up the following fixed-effect panel model.

$$ERPT_{jt} = \alpha + \boldsymbol{\beta}'\mathbf{X_t} + \lambda_t + \lambda_j + \varepsilon_{jt}, \qquad (9)$$

where $ERPT$ denotes the estimated coefficient of ERPT to domestic producer prices in equation (8); $\mathbf{X_t}$ denotes a vector of explanatory variables including *MInt* (share of imported intermediate inputs in total input of each industry), *ExY* (export share in total output of each industry), *BL* (backward linkage[15] of each industry), and *LY* (natural logarithm of the industry's total output). *j* and *t* denote an industry and time (2000, 2005, and 2011), respectively. λ_j and λ_t denote individual fixed effect and time effect, respectively. ε_{jt} is an error term. The result of

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[14] In practice, we investigated the effect of 50 percent increase in import price of the "coal mining, crude petroleum and natural gas" sector.

[15] See Miller and Blair (2009), p.555, for the definition of backward linkage.

Hausman test shows that the fixed effect model is more appropriate than the random effect model.

MInt (a share of imported intermediate inputs in total inputs) is calculated by:

$$MInt_j = \sum_i \alpha_{ij}^m , \qquad (10)$$

where α_{ij}^m is an element of matrix, $\mathbf{A^m}$, that denotes imported intermediate input coefficients of sector *j* from sector *i*.

BL (backward linkage of each industry) is calculated by:

$$BL_j = \sum_i l_{ij} , \qquad (11)$$

where l_{ij} is an element of the Leontief inverse matrix $(\mathbf{I} - \mathbf{A^d})^{-1}$.[16]

ExY (an export share in total output of each industry) is computed by:

$$ExY_j = \frac{Export_j}{Y_j}, \qquad (12)$$

where $Export_j$ and Y_j denote, respectively, the export amount and the total output of industry *j*.

The data of all explanatory variables are taken from Japanese IO table for 2000, 2005, and 2011 published by Ministry of International Affairs and Communications.

4.2 Results of Pass-Through Determinants

[16] See Appendix for further details.

Table 3 presents the results of fixed effect panel estimation where both cross-section and period effects are included. Results in the left-hand side and right-hand side, respectively, focus on all sectors and only manufacturing sectors in Japan. First, Table 3 clearly shows that estimated coefficients of *MInt* are positive and statistically significant. This finding is consistent with the results of Section 3, where the extent of ERPT tends to be high in the sectors related to energy and natural resources.

Second, estimated coefficients of *ExY* are not statistically significant at all, which indicates that the export share of the industry in question has no relationship with the degree of ERPT. However, the interaction effect ($MInt \cdot ExY$) is positive and statistically significant in manufacturing sectors, which implies that if a manufacturing sector tends not only to import more of intermediate inputs from abroad but also to export its products to foreign countries, the degree of ERPT to the sector's production price will increase.

Third, backward linkage (*BL*) takes positive and significant coefficient in all cases, which indicates that the broader the scope of production chains for an industry, the higher the degree of ERPT to the sector's production price. This result is reasonable, because a longer production chain tends to have larger cumulative impact of ERPT.

Finally, a natural log of the industry's total output has positive and significant impact on the extent of ERPT, likely because industry's total outputs may reflect its economic performance.

5 Concluding Remarks

This study proposed a new approach to ERPT along production chains by using an Input-Output (IO) table. We analyzed how exchange rate changes are transmitted from import prices to domestic producer prices through numerous stages of production by employing the Japanese IO tables of 2000, 2005, and 2011.

Main contribution of this paper is to develop a new IO approach to the ERPT analysis. We employed the following two-stage approach. First, we estimated the single-equation model to estimate the degree of ERPT to import prices. We used the state-space model to obtain the time-varying ERPT into import price of intermediate input goods. Second, using the estimated ERPT coefficients at the first stage, we analyzed how the ERPT effect is transmitted from import prices to domestic producer prices through numerous production stages at different industries. We compared the results of our two-stage approach with those of the conventional single-equation model. Furthermore, we conducted a panel estimation to examine the determinants of ERPT to domestic producer prices.

We demonstrated that our two-stage ERPT estimation can better capture the transmission of exchange rate changes to producer prices along production chains. The estimated ERPT coefficients obtained from the two-stage approach are positive and statistically significant in most cases, which contrast markedly with the insignificant ERPT coefficients obtained from the conventional approach. Thus, if taking into consideration both domestic and international production chains, the degree of ERPT to domestic producer prices become significantly higher. This aspect has not yet been empirically analyzed in the previous studies.

More importantly, by the fixed effect panel estimation, we revealed that if manufacturing sectors tend not only to import intermediate inputs from abroad but also to export their products to foreign countries, the degree of import pass-through to producer prices will increase significantly. While the extent of ERPT is in practice affected by various factors such as monetary policy and business cycles, it is demonstrated that growing international production sharing will have a positive impact on ERPT to domestic producer prices.

Appendix: Input-Output Analysis of Exchange Rate Pass-Through

This Appendix explains how to derive equation (8), and the following exposition is a straightforward extension of the price model based on monetary data presented by Miller and Blair (2009).[17] Figure A1 exhibits a single-country IO table with *n* sectors, each of which produces only one good.

Figure A1: Transactions in Monetary Terms

		Sectors						
	Sectors	1	…	j	…	n	Final Demand	Total Output
Domestic	1	z_{11}^d	…	z_{1j}^d	…	z_{1n}^d	f_1^d	y_1
	⋮	⋮		⋮		⋮	⋮	⋮
	n	z_{n1}^d	…	z_{nj}^d	…	z_{nn}^d	f_n^d	y_n
Import	1	z_{11}^m	…	z_{1j}^m	…	z_{1n}^m	f_1^m	
	⋮	⋮		⋮		⋮	⋮	
	n	z_{n1}^m	…	z_{nj}^m	…	z_{nn}^m	f_n^m	
	Labor	v_1	…	v_j	…	v_n		

In an IO table, total input of one sector is equal to total output of that sector. By summing down the *j*th column in Figure A1, we have:

$$y_j = \sum_{i=1}^{n} z_{ij}^d + \sum_{i=1}^{n} z_{ij}^m + v_j \qquad \text{(A1)}$$

or

$$\mathbf{y}' = \mathbf{i}'\mathbf{Z^d} + \mathbf{i}'\mathbf{Z^m} + \mathbf{v}' \qquad \text{(A2)}$$

where $\mathbf{v}' = (v_1, \ldots, v_n)$ that represent total value-added expenditures by each sector.

[17] See Miller and Blair (2009) pp.43-44 for further details.

$\mathbf{Z^d}$ denotes a domestic transactions matrix, $\mathbf{Z^m}$ denotes a transactions matrix of imported goods. Let $\mathbf{A^d}$ and $\mathbf{A^m}$ denote domestic input coefficient matrix and imported input coefficient matrix, respectively. Elements of $\mathbf{A^d}$ and $\mathbf{A^m}$ are defined as $a_{ij}^d = z_{ij}^d / y_j$ and $a_{ij}^m = z_{ij}^m / y_j$, respectively.

Substituting $\mathbf{Z^d} = \mathbf{A^d}\hat{\mathbf{y}}$ and $\mathbf{Z^m} = \mathbf{A^m}\hat{\mathbf{y}}$ into equation (A2), we obtain:

$$\mathbf{y}' = \mathbf{i}'\mathbf{A^d}\hat{\mathbf{y}} + \mathbf{i}'\mathbf{A^m}\hat{\mathbf{y}} + \mathbf{v}' \tag{A3}$$

where a "hat" over a vector denotes a diagonal matrix. Post-multiplying equation (A3) by $\hat{\mathbf{y}}^{-1}$ we have:

$$\mathbf{y}'\hat{\mathbf{y}}^{-1} = \mathbf{i}'\mathbf{A^d}\hat{\mathbf{y}}\hat{\mathbf{y}}^{-1} + \mathbf{i}'\mathbf{A^m}\hat{\mathbf{y}}\hat{\mathbf{y}}^{-1} + \mathbf{v}'\hat{\mathbf{y}}^{-1} \tag{A4}$$

or

$$\mathbf{i}' = \mathbf{i}'\mathbf{A^d} + \mathbf{i}'\mathbf{A^m} + \mathbf{v}'_{\mathbf{c}} \tag{A5}$$

where $\mathbf{v}'_{\mathbf{c}} = \mathbf{v}'\hat{\mathbf{y}}^{-1} = \left(v_1/y_1, \ldots, v_n/y_n\right)$ and the right-hand side of the above equations indicates the cost of inputs per unit of output. Since output prices, the left-hand side of equation (A5), are set equal to total cost of production , each price including both domestic and imported input prices is assumed to be equal to 1. Assuming that the base year domestic price index is $\tilde{p}_j^d$ and the base year import price index is $\tilde{p}_j^m$, $\tilde{\mathbf{P}}^{\mathbf{d}\prime} = \left(\tilde{p}_1^d, \ldots, \tilde{p}_n^d\right)$ and $\tilde{\mathbf{P}}^{\mathbf{m}\prime} = \left(\tilde{p}_1^m, \ldots, \tilde{p}_n^m\right)$. Thus, the IO price model is:

$$\tilde{\mathbf{P}}^{\mathbf{d}\prime} = \tilde{\mathbf{P}}^{\mathbf{d}\prime}\mathbf{A^d} + \tilde{\mathbf{P}}^{\mathbf{m}\prime}\mathbf{A^m} + \mathbf{v}'_{\mathbf{c}} \tag{A6}$$

which leads to:

$$\tilde{\mathbf{P}}^{\mathbf{d}\,\prime} = \left(\tilde{\mathbf{P}}^{\mathbf{m}\,\prime}\mathbf{A}^{\mathbf{m}} + \mathbf{v}_{\mathbf{c}}'\right)\left(\mathbf{I} - \mathbf{A}^{\mathbf{d}}\right)^{-1}. \tag{A7}$$

When the price of imported intermediate inputs changes by $\Delta\mathbf{P}^{\mathbf{m}}$ and the other factors are constant, the change in domestic producer prices ($\Delta\mathbf{P}^{\mathbf{d}}$) is:

$$\Delta\mathbf{P}^{\mathbf{d}\,\prime} = \Delta\mathbf{P}^{\mathbf{m}\,\prime}\mathbf{A}^{\mathbf{m}}\left(\mathbf{I} - \mathbf{A}^{\mathbf{d}}\right)^{-1} \tag{A8}$$

or

$$\Delta\mathbf{P}^{\mathbf{d}} = \left(\mathbf{I} - \mathbf{A}^{\mathbf{d}\,\prime}\right)^{-1}\mathbf{A}^{\mathbf{m}\,\prime}\Delta\mathbf{P}^{\mathbf{m}}. \tag{A9}$$

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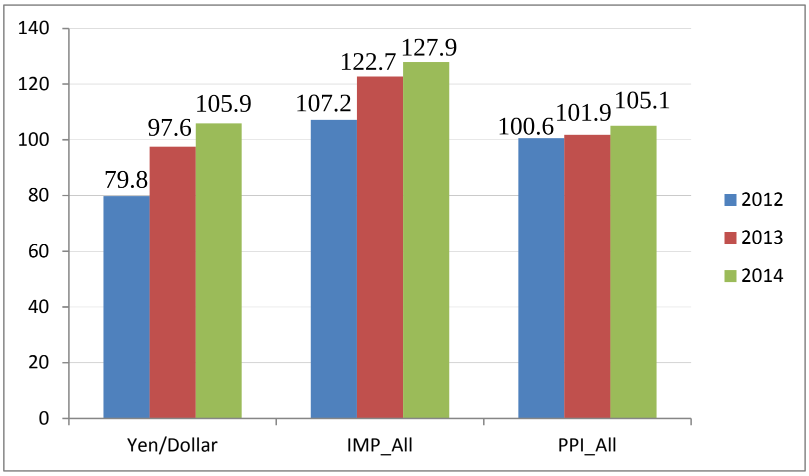
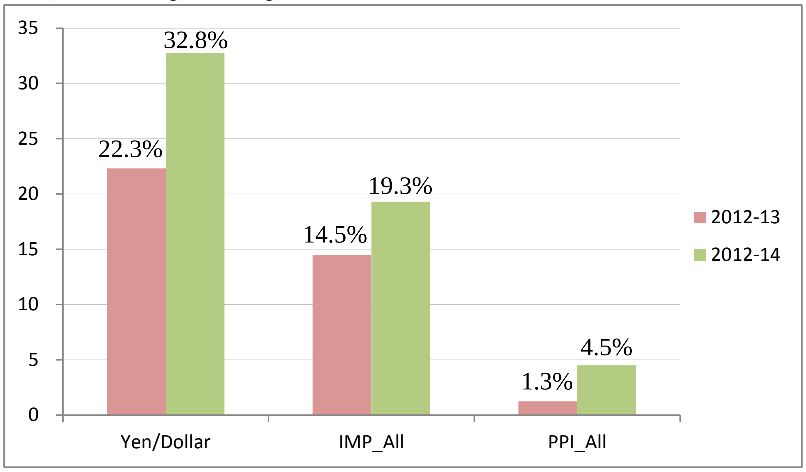
Figure 1. Changes in Nominal Exchange Rate, Import Prices, and Producer Prices

1a) Yen/Dollar Rate, IMP (2010=100), and PPI (2010=100)

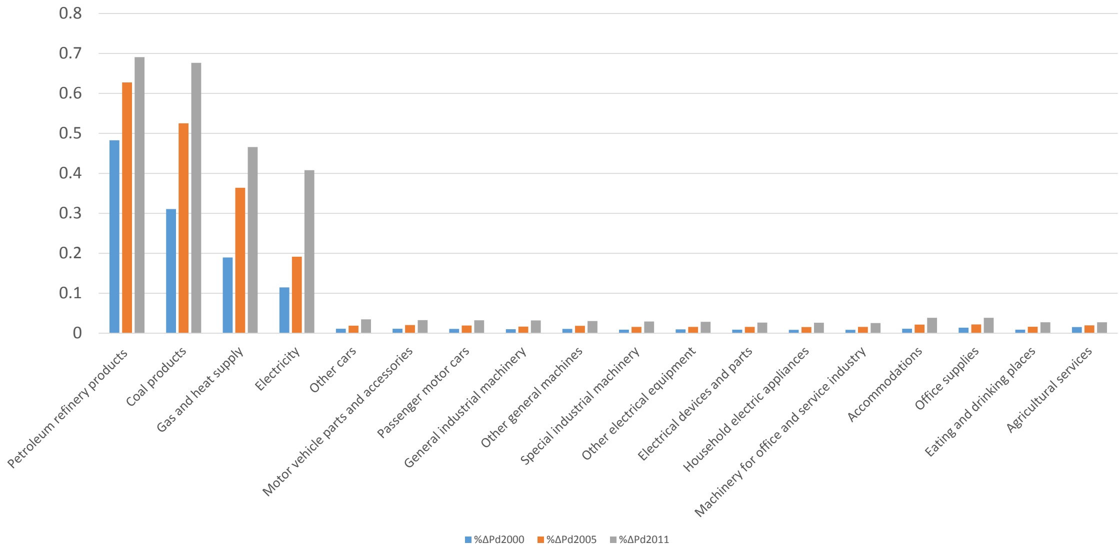


1b) Percentage Change from 2012 to 2013 and from 2012 to 2014



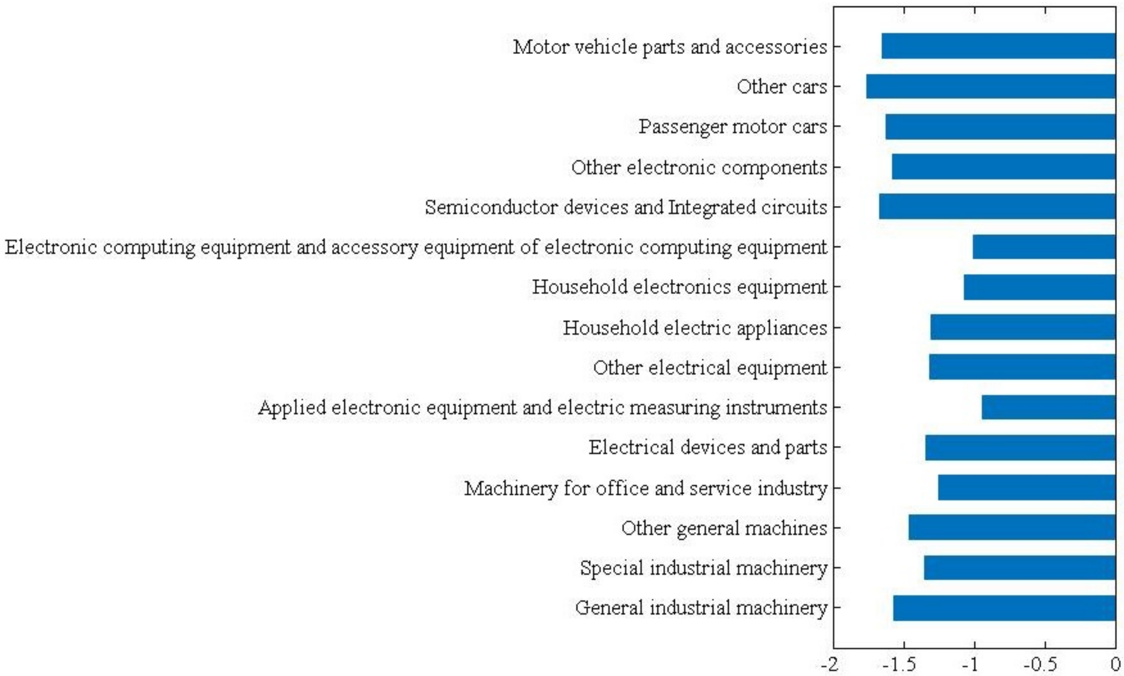
Note: "Yen/Dollar" denotes the nominal exchange rate of the yen vis-à-vis the U.S. dollar. "IMP_All" denotes the import price index (2010=100) of all manufacturing. "PPI_All" denotes the producer price index (2010=100) of all manufacturing.
Source: Bank of Japan; and CEIC Database.

Figure 2. Effect of Oil Price Change on Domestic Producer Prices



Note: We calculate the effect of 1 percent change in the price of "coal mining, crude petroleum and natural gas" on domestic producer prices of selected industries. Vertical axis indicates percentage.

Figure 3. Effect of 50 Percent Decline in Oil Price on Domestic Producer Prices



Note: We calculate the effect of 50 percent decline in the price of "coal mining, crude petroleum and natural gas" on domestic producer prices of selected industries. Horizontal axis indicates percentage.

Table 1. Exchange Rate Pass-Through of Japanese Imports

No.	Industry:	2000	2005	2011
1	Crop cultivation	0.97 *	0.51	1.01 *
6	Metallic ores	1.18 *	0.72	2.30 *
7	Non-metallic ores	1.03 *	0.75	0.75
8	Coal mining, crude petroleum and natural gas	1.14 *	1.06	1.29
9	Foods	0.97 *	0.80 *	0.91 *
10	Beverage	0.99 *	1.05 *	0.96 *
11	Feeds and organic fertilizer, n.e.c.	1.05 *	1.01 *	0.96 *
13	Textile products	0.84 *	0.84	0.83
14	Wearing apparel and other textile products	0.87 *	0.87 *	0.87 *
15	Timber and wooden products	0.98 *	0.93 *	1.06 *
16	Furniture and fixtures	1.00 *	1.02 *	0.96 *
17	Pulp, paper, paperboard, building paper	1.12 *	1.02 *	1.31 *
18	Paper products	1.02 *	1.03 *	1.12 *
20	Chemical fertilizer	0.98 *	0.94	0.73
23	Organic chemical products (except Petrochemical basic products)	1.13 *	0.60	1.35
26	Medicaments	0.92 *	0.86 *	0.88 *
27	Final chemical products, n.e.c.	0.87 *	0.98 *	0.84 *
28	Petroleum refinery products	1.42 *	0.60	1.78 *
30	Plastic products	1.07 *	0.83 *	1.13 *
31	Rubber products	0.99 *	1.00 *	0.88 *
32	Leather, fur skins and miscellaneous leather products	1.00 *	1.01 *	1.02 *
33	Glass and glass products	1.01 *	1.09 *	0.96 *
35	Pottery, china and earthenware	0.90 *	1.13 *	0.64 *
36	Other ceramic, stone and clay products	1.01 *	0.83 *	0.98 *
37	Pig iron and crude steel	0.77 *	0.78	0.77
41	Non-ferrous metals	1.03 *	0.47	1.25 *
43	Metal products for construction and architecture	1.01 *	0.80 *	0.76 *
45	General industrial machinery	0.91 *	1.02 *	1.05 *
46	Special industrial machinery	0.98 *	1.00 *	1.04 *
47	Other general machines	1.08 *	1.31 *	1.05 *
48	Machinery for office and service industry	1.08 *	1.25 *	1.01 *
49	Electrical devices and parts	1.00 *	0.85 *	0.73
50	Applied electronic equipment and electric measuring instruments	0.98 *	0.91 *	1.15 *
52	Household electric appliances	0.95 *	1.12 *	0.82 *
53	Household electronics equipment	0.96 *	1.09 *	0.92 *
54	Electronic computing equipment and accessory equipment of electronic computing equipment	0.99 *	0.85	1.03 *
55	Semiconductor devices and Integrated circuits	1.00 *	1.08 *	1.07 *
56	Other electronic components	1.02 *	1.06 *	0.78 *
57	Passenger motor cars	0.67 *	1.06 *	0.35
58	Other cars	1.02 *	1.13 *	1.07 *
59	Motor vehicle parts and accessories	1.02 *	1.18 *	0.96 *
61	Other transportation equipment and repair of transportation equipment	1.01 *	1.00 *	1.13 *
62	Precision instruments	0.99 *	1.05 *	1.11 *
63	Miscellaneous manufacturing products	1.01 *	1.01 *	1.11 *

Note: An average of time-varying ERPT coefficients for 12 months of each year is reported. Significance level (*) is calculated based on the two standard error confidence bands. The far left column indicates the classification of IO table.

Table 2. Exchange Rate Pass-Through to Producer Prices

ERPT to Producer Prices		**Single-Equation Estimation**			**Two Stage Estimation**		
No.	**Sector**	**2000**	**2005**	**2011**	**2000**	**2005**	**2011**
1	Crop cultivation	-0.132	-0.301	0.230	0.046 *	0.062	0.111
9	Foods	-0.027	-0.004	-0.040	0.110 *	0.111 *	0.188 *
10	Beverage	-0.008	0.015	0.004	0.056 *	0.061	0.127 *
11	Feeds and organic fertilizer, n.e.c.	-0.069	0.110	-0.028	0.323 *	0.235	0.528 *
13	Textile products	0.013	0.000	0.172	0.125 *	0.125	0.228
14	Wearing apparel and other textile products	-0.028	0.038	-0.032	0.094 *	0.127	0.192 *
15	Timber and wooden products	0.012	-0.002	0.069	0.067 *	0.079 *	0.142 *
16	Furniture and fixtures	0.010	-0.023	0.001	0.083 *	0.096 *	0.169 *
17	Pulp, paper, paperboard, building paper	-0.083	0.038	-0.046	0.175 *	0.175 *	0.290 *
18	Paper products	-0.002	-0.004	-0.034	0.087 *	0.097 *	0.174 *
20	Chemical fertilizer	-0.080	0.106	-0.111	0.164 *	0.220	0.270
23	Organic chemical products (except Petrochemical basic products)	0.110 *	-0.048	0.456	0.303 *	0.267	0.673
26	Medicaments	0.070	0.140	-0.873	0.058 *	0.060	0.136 *
27	Final chemical products, n.e.c.	-0.031	0.033	-0.120	0.116 *	0.121	0.302
28	Petroleum refinery products	0.325	0.108	0.565	0.552 *	0.670	0.928
30	Plastic products	0.009	0.003	-0.008	0.110 *	0.109	0.244
31	Rubber products	-0.010	0.031	-0.096	0.119 *	0.113	0.302 *
32	Leather, fur skins and miscellaneous leather products	-0.016	-0.004	-0.008	0.166 *	0.174 *	0.190 *
33	Glass and glass products	-0.022	-0.037	-0.003	0.066 *	0.078	0.171 *
35	Pottery, china and earthenware	0.005	-0.004	0.022	0.086 *	0.101	0.196 *
36	Other ceramic, stone and clay products	-0.016	0.016	-0.021	0.092 *	0.099	0.212 *
37	Pig iron and crude steel	0.100	0.121	0.715	0.250 *	0.277	0.837 *
41	Non-ferrous metals	0.475	0.263	0.645	0.407 *	0.379	1.097 *
43	Metal products for construction and architecture	0.038	-0.069	0.085	0.058 *	0.069	0.241 *
45	General industrial machinery	0.002	-0.013	-0.020	0.087 *	0.103 *	0.196 *
46	Special industrial machinery	-0.033	-0.069	-0.011	0.068 *	0.086 *	0.175 *
48	Machinery for office and service industry	-0.013	0.107	-0.046	0.103 *	0.156 *	0.198 *
49	Electrical devices and parts	-0.005	-0.018	0.133	0.074 *	0.100	0.192 *
50	Applied electronic equipment and electric measuring instruments	-0.009	0.298	-0.043	0.095 *	0.201 *	0.229 *
52	Household electric appliances	-0.013	0.288	0.247	0.114 *	0.149 *	0.216 *
53	Household electronics equipment	-0.026	0.311	0.110	0.124 *	0.206 *	0.223 *
55	Semiconductor devices and Integrated circuits	-0.029	0.168	0.126	0.064 *	0.132 *	0.210 *
57	Passenger motor cars	-0.013	-0.049	0.068	0.071 *	0.100	0.203 *
58	Other cars	-0.002	0.049	0.036	0.065 *	0.108 *	0.203 *
59	Motor vehicle parts and accessories	-0.083	0.022	-0.097	0.065 *	0.092	0.188 *
61	Other transportation equipment and repair of transportation equipment	0.035	-0.003	0.167	0.144 *	0.155 *	0.245 *
62	Precision instruments	-0.010	0.002	-0.038	0.107 *	0.098 *	0.181 *
63	Miscellaneous manufacturing products	-0.001	0.042	0.006	0.083 *	0.093	0.181 *

Note: Results of ERPT to domestic producer prices are reported. “Single-Equation Estimation” shows the ERPT coefficient obtained from the estimation of the conventional single equation model. “Two Stage Estimation” shows the ERPT coefficient obtained from the first stage state-space estimation and the second stage IO analysis. Significance level (*) is calculated based on the two standard error confidence bands.

Table 3. Determinants of Exchange Rate Pass-Through to Producer Prices

Dependent variable: ERPT coefficient

VARIABLES:	All Sectors (1)	(2)	(3)	(4)	Manufacturing Sectors (5)	(6)	(7)	(8)
Imported Input Coefficient (*MInt*)	1.367***	1.532***	1.484***	1.328***	1.094***	1.425***	1.394***	1.118***
	(0.130)	(0.121)	(0.118)	(0.189)	(0.160)	(0.197)	(0.195)	(0.289)
Export/Output (*ExY*)	0.233		0.256	0.010	0.280		0.292	-0.186
	(0.202)		(0.204)	(0.138)	(0.246)		(0.256)	(0.236)
(*MInt*)*(*ExY*)				1.603				2.890**
				(1.387)				(1.259)
Backward Linkage (*BL*)		0.139***	0.146***	0.152***		0.214**	0.220**	0.259***
		(0.049)	(0.050)	(0.045)		(0.103)	(0.099)	(0.083)
Log of Output (*LY*)	0.038*	0.043**	0.046**	0.040**	0.071**	0.080**	0.079**	0.071**
	(0.020)	(0.019)	(0.021)	(0.019)	(0.035)	(0.034)	(0.035)	(0.032)
Constant	-0.590*	-0.922***	-0.996***	-0.897***	-1.075*	-1.650***	-1.677**	-1.572***
	(0.322)	(0.318)	(0.366)	(0.330)	(0.536)	(0.550)	(0.634)	(0.575)
Cross-section Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Period Effect	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	323	323	323	323	165	165	165	165
R-squared	0.62	0.62	0.63	0.65	0.67	0.67	0.68	0.72

Note: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, * p<0.10

Appendix Table 1. List of 108 Industries

No	***Name of Sectors***	***No***	***Name of Sectors***
1	Crop cultivation	55	Semiconductor devices and Integrated circuits
2	Livestock	56	Other electronic components
3	Agricultural services	57	Passenger motor cars
4	Forestry	58	Other cars
5	Fisheries	59	Motor vehicle parts and accessories
6	Metallic ores	60	Ships and repair of ships
7	Non-metallic ores	61	Other transportation equipment and repair of transportation equipment
8	Coal mining , crude petroleum and natural gas	62	Precision instruments
9	Foods	63	Miscellaneous manufacturing products
10	Beverage	64	Reuse and recycling
11	Feeds and organic fertilizer, n.e.c.	65	Building construction
12	Tobacco	66	Repair of construction
13	Textile products	67	Public construction
14	Wearing apparel and other textile products	68	Other civil engineering and construction
15	Timber and wooden products	69	Electricity
16	Furniture and fixtures	70	Gas and heat supply
17	Pulp, paper, paperboard, building paper	71	Water supply
18	Paper products	72	Waste management service
19	Printing, plate making and book binding	73	Commerce
20	Chemical fertilizer	74	Finance and insurance
21	Industrial inorganic chemicals	75	Real estate agencies and rental services
22	Petrochemical basic products	76	House rent
23	Organic chemical products (except Petrochemical basic products)	77	House rent (imputed house rent)
24	Synthetic resins	78	Railway transport
25	Synthetic fibers	79	Road transport (except transport by private cars)
26	Medicaments	80	Self-transport by private cars
27	Final chemical products, n.e.c.	81	Water transport
28	Petroleum refinery products	82	Air transport
29	Coal products	83	Freight forwarding
30	Plastic products	84	Storage facility service
31	Rubber products	85	Services relating to transport
32	Leather, fur skins and miscellaneous leather products	86	Communication
33	Glass and glass products	87	Broadcasting
34	Cement and cement products	88	Information services
35	Pottery, china and earthenware	89	Internet based services
36	Other ceramic, stone and clay products	90	Image information,character information production and distribution
37	Pig iron and crude steel	91	Public administration
38	Steel products	92	Education
39	Cast and forged steel products	93	Research
40	Other iron or steel products	94	Medical service and health
41	Non-ferrous metals	95	Social security
42	Non-ferrous metal products	96	Nursing care
43	Metal products for construction and architecture	97	Other public services
44	Other metal products	98	Advertising services
45	General industrial machinery	99	Goods rental and leasing services
46	Special industrial machinery	100	Repair of motor vehicles and machine
47	Other general machines	101	Other business services
48	Machinery for office and service industry	102	Amusement and recreational services
49	Electrical devices and parts	103	Eating and drinking places
50	Applied electronic equipment and electric measuring instruments	104	Accommodations
51	Other electrical equipment	105	Cleaning, barber shops, beauty shops and public baths
52	Household electric appliances	106	Other personal services
53	Household electronics equipment	107	Office supplies
54	Electronic computing equipment and accessory equipment of electronic computing equipment	108	Activities not elsewhere classified

Note: 108 industries are based on 2005 Japanese IO table.

Appendix Table 2. Effect of Import Price Change in “Coal Mining, Crude Petroleum and Natural Gas” on Producer Prices

No.	*Name of Sectors*	2000	2005	2011	*No.*	*Name of Sectors*	2000	2005	2011
1	Crop cultivation	0.013	0.025	0.037	55	Semiconductor devices and Integrated circuits	0.010	0.019	0.033
2	Livestock	0.012	0.018	0.028	56	Other electronic components	0.009	0.017	0.031
3	Agricultural services	0.016	0.020	0.027	57	Passenger motor cars	0.011	0.019	0.033
4	Forestry	0.013	0.017	0.032	58	Other cars	0.011	0.019	0.035
5	Fisheries	0.028	0.062	0.073	59	Motor vehicle parts and accessories	0.011	0.021	0.033
6	Metallic ores	0.037	0.054	0.062	60	Ships and repair of ships	0.013	0.026	0.042
7	Non-metallic ores	0.052	0.078	0.122	61	Other transportation equipment and repair of transportation equipment	0.009	0.020	0.029
8	Coal mining, crude petroleum and natural gas	0.018	0.026	0.044	62	Precision instruments	0.008	0.015	0.029
9	Foods	0.012	0.021	0.030	63	Miscellaneous manufacturing products	0.013	0.019	0.029
10	Beverage	0.009	0.014	0.021	64	Reuse and recycling	0.142	0.032	0.050
11	Feeds and organic fertilizer, n.e.c.	0.012	0.015	0.020	65	Building construction	0.012	0.018	0.026
12	Tobacco	0.003	0.005	0.005	66	Repair ofconstruction	0.012	0.019	0.029
13	Textile products	0.016	0.030	0.050	67	Public construction	0.021	0.036	0.054
14	Wearing apparel and other textile products	0.009	0.017	0.031	68	Other civil engineering and construction	0.015	0.026	0.036
15	Timber and wooden products	0.011	0.018	0.027	69	Electricity	0.115	0.192	0.405
16	Furniture and fixtures	0.010	0.018	0.030	70	Gas and heat supply	0.189	0.364	0.466
17	Pulp, paper, paperboard, building paper	0.030	0.044	0.084	71	Water supply	0.019	0.029	0.041
18	Paper products	0.015	0.022	0.042	72	Waste management service	0.012	0.023	0.038
19	Printing, plate making and book binding	0.009	0.014	0.029	73	Commerce	0.008	0.014	0.024
20	Chemical fertilizer	0.043	0.054	0.085	74	Finance and insurance	0.003	0.005	0.009
21	Industrial inorganic chemicals	0.034	0.050	0.089	75	Real estate agencies and rental services	0.005	0.008	0.018
22	Petrochemical basic products	0.063	0.171	0.155	76	House rent	0.003	0.004	0.008
23	Organic chemical products (except Petrochemical basic products)	0.036	0.085	0.092	77	House rent (imputed house rent)	0.001	0.001	0.003
24	Synthetic resins	0.030	0.070	0.078	78	Railway transport	0.010	0.017	0.023
25	Synthetic fibers	0.025	0.054	0.082	79	Road transport (except transport by private cars)	0.034	0.048	0.058
26	Medicaments	0.009	0.016	0.022	80	Self-transport by private cars	0.149	0.202	0.253
27	Final chemical products, n.e.c.	0.015	0.028	0.039	81	Water transport	0.018	0.039	0.054
28	Petroleum refinery products	0.483	0.628	0.697	82	Air transport	0.021	0.036	0.119
29	Coal products	0.311	0.525	0.679	83	Freight forwarding	0.013	0.017	0.030
30	Plastic products	0.016	0.027	0.037	84	Storage facility service	0.010	0.016	0.028
31	Rubber products	0.016	0.025	0.035	85	Services relating to transport	0.006	0.010	0.015
32	Leather, fur skins and miscellaneous leather products	0.008	0.014	0.021	86	Communication	0.005	0.007	0.015
33	Glass and glass products	0.022	0.032	0.054	87	Broadcasting	0.007	0.010	0.017
34	Cement and cement products	0.029	0.048	0.084	88	Information services	0.006	0.008	0.012
35	Pottery, china and earthenware	0.022	0.038	0.064	89	Internet based services	n.a.	0.009	0.015
36	Other ceramic, stone and clay products	0.024	0.039	0.069	90	Image information,character information production and distribution	0.009	0.013	0.023
37	Pig iron and crude steel	0.047	0.095	0.117	91	Public administration	0.008	0.013	0.019
38	Steel products	0.033	0.063	0.098	92	Education	0.005	0.009	0.017
39	Cast and forged steel products	0.031	0.048	0.091	93	Research	0.012	0.022	0.023
40	Other iron or steel products	0.022	0.043	0.070	94	Medical service and health	0.008	0.012	0.016
41	Non-ferrous metals	0.022	0.020	0.029	95	Social security	0.007	0.010	0.020
42	Non-ferrous metal products	0.015	0.016	0.025	96	Nursing care	0.007	0.010	0.016
43	Metal products for construction and architecture	0.013	0.024	0.046	97	Other public services	0.006	0.011	0.016
44	Other metal products	0.013	0.022	0.040	98	Advertising services	0.006	0.011	0.019
45	General industrial machinery	0.010	0.017	0.031	99	Goods rental and leasing services	0.004	0.007	0.012
46	Special industrial machinery	0.009	0.016	0.027	100	Repair of motor vehicles and machine	0.008	0.014	0.023
47	Other general machines	0.011	0.019	0.029	101	Other business services	0.004	0.006	0.011
48	Machinery for office and service industry	0.009	0.016	0.025	102	Amusement and recreational services	0.010	0.018	0.030
49	Electrical devices and parts	0.009	0.016	0.027	103	Eating and drinking places	0.009	0.016	0.027
50	Applied electronic equipment and electric measuring instruments	0.007	0.011	0.019	104	Accommodations	0.011	0.022	0.039
51	Other electrical equipment	0.010	0.016	0.026	105	Cleaning, barber shops, beauty shops and public baths	0.009	0.017	0.029
52	Household electric appliances	0.009	0.015	0.026	106	Other personal services	0.009	0.015	0.026
53	Household electronics equipment	0.008	0.013	0.021	107	Office supplies	0.014	0.022	0.038
54	Electronic computing equipment and accessory equipment of electronic computing equipment	0.007	0.012	0.020	108	Activities not elsewhere classified	0.013	0.028	0.041

Note: See Figure 2.