# A Comparative study on resource saving technology based on OECD I-O database

FUJIKAWA, Kiyoshi[a], INADA, Yoshihisa[b]
SHIMODA, Mitsuru[c], WATANABE, Takatoshi[d]

During two decades after 1980, the oil price has been rather stable except the period of the Gulf War in 1991. Recent years after late 1990s, however, the oil price started to soar again. Although various kinds of energy conservation technologies have been developed after the oil crises of 1970s, deeper impacts might be brought on the economy of non-oil-producing countries if the oil price still continues to rise at the pace of recent years.

The purpose of this paper is to examine how the vulnerability of the industrial countries to the change in the price of natural resources has been eased during recent three decades. The progress of resources saving technology can be analyzed through two points of view; quantity side and price side. As to the quantity side, energy intensity of each sector would have been decreased if saving technology for imported resource had been developed. However, energy intensity is also affected by the final demand structure and the import structure as well as the input-output structure. Therefore, the change in energy intensity needs to be analyzed by decomposing these factors. On the other hand, as to the price side, price sensitivity of each sector to energy price change would have become smaller certainly if technological progress of imported resource saving had occurred. This price sensitivity also can be affected by such several factors as the input-output structure, import structure, and the initial level of the energy price. So, the domestic price change induced by the energy price change also needs to be analyzed by decomposing several factors.

Since OECD has a long-term time series input-output table database with the comparable industry classification in such countries as G7 countries, Australia, Denmark and the Netherlands, we will make use of those IO tables for the analysis.

Key words: oil price, imported natural resources, input-output analysis, energy intensity, sensitivity of price
JEL Classification: C67, F14, Q43, Q55

## 1 Introduction

Figure 1 shows the time series change in CIF import price for Japan and the USA. As is shown in Figure 1, the oil embargo in 1973 raised the crude oil price that used to be about two dollars per barrel up to about 35 dollars per barrel. Since the import quantity of oil was also restricted those days, this impact was so large that much of mass media reported the economy of industrialized countries would have collapsed. To be sure, when we take Japan for example, Japanese economy recorded a minus growth in 1974 for the first time in the postwar history, however the adjustment ability of the market economy was much stronger than the most media had expected. After the oil crises various kinds of energy saving technologies have been developed and as a result the demand pressure in the oil market came to be weaker gradually. So the oil price dropped around 20 dollars per barrel after 1985: reverse oil shock.

Figure 2 shows the time series change of the final energy consumption to real GDP in terms of PPP in Japan, the USA and Europe OECD countries, where a downward trend, or improvement of energy efficiency, is observed. For example in the USA, while the final energy consumption per GDP was 420 (toe/million USD) in 1971, the ratio decreased less than a half of 1971 to 209 (toe/million USD) in 2003.

During two decades after 1980 the oil price has been rather stable except for the period of the Gulf War in 1991 as is shown in Figure 1. Recent years after late 1990s, however, the oil price started to soar and recorded the historical high price of 37 dollars per barrel in 2004. The oil price shot up to 80 dollars in early September in 2005 due to Hurricane Katrina that brought extensive damages to the Southern US.

It is said that there are following four factors in the background of the recent oil price hike.

1) A bullish expectation on oil demand in addition to a present demand increase in the world oil market.
2) Insufficient investment in both upstream sector (oil development) and downstream sector (oil refinement) because of relatively cheap oil during two decades after 1980.
3) Geopolitical risks in the region where petroleum resources exist.
4) An increase in the oil buying and selling for speculation purpose

A bullish oil demand is expected to continue for a certain period because of high economic growth of newly industrializing countries such as China and India even though the factors 2, 3, and 4 are relatively short-term market disturbances. To be sure, various kinds of energy conservation technologies have been developed after the oil crises in 1970s, and it is said that the efficiency improvement in energy use will fairly loosen the impacts of oil price hike on the oil importing countries[1]. However, it is unlikely that the oil price will decrease again to around 20 dollars per barrel taking such economic growth of newly industrializing countries into account. As is shown in Figure 3, the energy demand increase in China is remarkable especially after 2000. Therefore, if the oil price still continues to rise at the pace of recent years, deep impacts might be brought on the economy of non-oil-producing countries[2].

The purpose of this paper is to examine how oil-saving technology has actually advanced during the recent three decades taking into account the changes in industrial structure as well as production structure. In order to attempt the analysis, input-output tables act as the most convenient tools. Fortunately OECD has a time series input-output table database with the comparable industry classification in countries such as G7 countries, Australia, Denmark and the Netherlands, so we make use of this database for the analysis. Though these I-O tables are very useful for our analysis since domestic inputs and imported inputs are recorded separately, unfortunately ‘Oil’ is not picked up as the independent industrial sectors but is included in ‘Mining’ sector. Therefore, we will hereinafter use such words as natural resources saving technology or natural resources intensity instead of oil-saving technology or oil intensity.

In the framework of I-O analysis, improvement in the use of resources can be observed from two aspects, that is, quantity and price. As to the quantity side, energy intensity of each sector is sure to decrease if imported resources saving technology develops. However, energy intensity is also affected by the final demand structure and the import structure as well as the input-output structure. Therefore, the change in energy intensity needs to be analyzed by decomposing these factors. On the other hand, as to price side, price sensitivity of each sector to energy price change would have become smaller certainly if the technological progress of imported resources saving had occurred. This price sensitivity also can be affected by such several factors as the input-output structure, import structure, and the initial level of the energy price. So, a change in the domestic price induced by the energy price change also needs to be analyzed by decomposing the above factors.

Results for Japan and the USA are summarized as follows. As to the Imported

Natural Resources Intensity (INRI), or the amount of the imported resources that the domestic final demand requires, Japan recorded a remarkable decrease in INRI after the oil crisis. On the other hand, INRI in the USA was almost flat except for the year 1977, when the intensity rose surprisingly. The level of INRI of the USA is lower than that of Japan while the margin of decrease in Japan was larger than that in the USA

The Japanese domestic prices were much more sensitive to those of imported natural resources when compared with the USA. After the oil crises, the degree of sensitivity in Japan rapidly declined, while the sensitivity in the USA almost remained unchanged. As a result, the sensitivity in Japan almost reached to the magnitude of that in the USA.

## 2 The Model

### 2-1 imported natural resource intensity

Leontief(1966) showed how input-output tables could be used to show the relation between sector outputs and sector final demands or between sector prices and sector values added. If $\mathbf{f_d}$ and $\mathbf{x}$ represent a column vector of domestic final demand values and a column vector of domestic gross output values, respectively, the fundamental equation in input-output analysis is

$$\mathbf{x} = (\mathbf{I} - \mathbf{A_d})^{-1}\mathbf{f_d} = \mathbf{B_d}\mathbf{f_d} \tag{1}$$

This equation shows how a column vector of final demand values can be transformed into estimates of gross output values. The matrix $\mathbf{I}$ is the identity matrix with ones on the diagonal and zeros off the diagonal and the elements of the matrix $\mathbf{A_d}$ are domestic input coefficients that show the relationship of domestic inputs of one sector to gross outputs of another. The matrix of $(\mathbf{I} - \mathbf{A_d})^{-1}$ is called the inverse matrix of Leontief whose elements mean direct and indirect requirement in one sector by unit production of another sector. And the imported inputs are expressed as follows:

$$\mathbf{m} = \mathbf{A_m}\mathbf{x} = \mathbf{A_m}\mathbf{B_d}\mathbf{f_d} \tag{2}$$

The elements of matrix $\mathbf{A_m}$ are imported input coefficients that show the relationship of imported inputs of one sector to gross outputs of another. Since our interest is to compare production structures among countries, the demand structure should be standardized, for example, as is shown in equation (3).

$$\overline{\mathbf{m}} = \mathbf{A_m}\mathbf{B_d}\bar{\mathbf{f}}_\mathbf{d}, \text{ where } (1,\cdots,1)\bar{\mathbf{f}}_\mathbf{d} = \boldsymbol{\iota}\bar{\mathbf{f}}_\mathbf{d} = 1 \tag{3}$$

$\overline{\mathbf{m}}$ is a vector that expresses quantity of imported inputs contained in one unit of domestic output. And the natural resources intensity, or the additional requirement of natural resources by additional one unit increase of final demand, is the corresponding element to Mining sector (the second element) of the vector $\overline{\mathbf{m}}$.

When we have I-O tables by time series, we can analyze how overtime changes took place in natural resources intensity of an economy. Suppose we have two I-O tables of the period 0 and 1. Assuming the total of the final demand is 1 for a comparison, the difference of natural resources intensity between the two periods would be decomposed as follows.

$$\begin{aligned} d\overline{\mathbf{m}} = \overline{\mathbf{m}}(1) - \overline{\mathbf{m}}(0) = & [\mathbf{A_m}(1) - \mathbf{A_m}(0)]\mathbf{B_d}(0)\bar{\mathbf{f}}_\mathbf{d}(0) \\ & + \mathbf{A_m}(1)[\mathbf{B_d}(1) - \mathbf{B_d}(0)]\bar{\mathbf{f}}_\mathbf{d}(0) \\ & + \mathbf{A_m}(1)\mathbf{B_d}(1)[\bar{\mathbf{f}}_\mathbf{d}(1) - \bar{\mathbf{f}}_\mathbf{d}(0)] \end{aligned} \quad (4)$$

The first term in the right part of equation (4) stands for the effect of change in the import coefficients, the second term means the effect of change in the domestic input coefficients, and the third term shows the effect of change in the final demand structure.

### 2-2 domestic price sensitivity on imported natural resource price

Leontief also constructed a relationship with output price and input cost in the price side.

$$\mathbf{p_d} = (\mathbf{v} + \mathbf{p_m A_m})(\mathbf{I} - \mathbf{A_d})^{-1} = (\mathbf{v} + \mathbf{p_m A_m})\mathbf{B_d} \quad (5)$$

The vector $\mathbf{p_d}$ is a row vector of domestic prices and the vector $\mathbf{p_m}$ is a row vector of prices of imported goods respectively, while the vector of $\mathbf{v}$ is a row vector of value-added ratio or value-added per unit of gross output.

Suppose the price change of imported inputs is expressed by $\overline{\mathbf{p}}_\mathbf{m}$, induced change in the equilibrium domestic price $\overline{\mathbf{p}}_\mathbf{d}$ will be expressed as follows.

$$\overline{\mathbf{p}}_\mathbf{d} = \overline{\mathbf{p}}_\mathbf{m}\mathbf{A_m B_d} \quad (6)$$

We can call $\overline{\mathbf{p}}_\mathbf{d}$ domestic price sensitivity on imported input price and the corresponding element to Mining sector (the second element) is domestic price sensitivity on imported natural resource price. The larger is this figure, the more sensitive is the domestic price to changes in prices of imported natural resource.

The over time change in domestic price sensitivity between the two periods of 0 and 1 would be decomposed as follows.

$$d\overline{\mathbf{p}}_{\mathbf{d}} = \overline{\mathbf{p}}_{\mathbf{d}}(1) - \overline{\mathbf{p}}_{\mathbf{d}}(0) = [\overline{\mathbf{p}}_{\mathbf{m}}(1) - \overline{\mathbf{p}}_{\mathbf{m}}(0)]\mathbf{A}_{\mathbf{m}}(0)\mathbf{B}_{\mathbf{d}}(0) + \overline{\mathbf{p}}_{\mathbf{m}}(1)[\mathbf{A}_{\mathbf{m}}(1) - \mathbf{A}_{\mathbf{m}}(0)]\mathbf{B}_{\mathbf{d}}(0) + \overline{\mathbf{p}}_{\mathbf{m}}(1)\mathbf{A}_{\mathbf{m}}(1)[\mathbf{B}_{\mathbf{d}}(1) - \mathbf{B}_{\mathbf{d}}(0)] \quad (7)$$

The first term in the right hand side of equation (7) stands for a factor of difference of the size of initial price change in imported inputs. Even though we assume the same rate of price change in imported inputs, say 100%, for the both period o and 1, the size of initial price change in imported inputs is not the same. The first term stands for this factor. And the second term expresses a factor of change in import coefficients, and the third term denotes a factor of change in the domestic input coefficients.

Moreover, so-called general price is a weighted average of sector-wise domestic prices. The general domestic price, therefore, is affected by a share structure of domestic demands. As a result, the difference in sensitivity of the general price on the change in imported natural resources can be expressed as follows.

$$\begin{aligned} \mathbf{w}(1)\overline{\mathbf{p}}_{\mathbf{d}}(1) - \mathbf{w}(0)\overline{\mathbf{p}}_{\mathbf{d}}(0) &= (\mathbf{w}(1) - \mathbf{w}(0))\overline{\mathbf{p}}_{\mathbf{d}}(0) + \mathbf{w}(1)(\overline{\mathbf{p}}_{\mathbf{d}}(1) - \overline{\mathbf{p}}_{\mathbf{d}}(0)) \\ &= (\mathbf{w}(1) - \mathbf{w}(0))\overline{\mathbf{p}}_{\mathbf{d}}(0) \\ &+ \mathbf{w}(1)[\overline{\mathbf{p}}_{\mathbf{m}}(1) - \overline{\mathbf{p}}_{\mathbf{m}}(0)]\mathbf{A}_{\mathbf{m}}(0)\mathbf{B}_{\mathbf{d}}(0) \\ &+ \mathbf{w}(1)\overline{\mathbf{p}}_{\mathbf{m}}(1)[\mathbf{A}_{\mathbf{m}}(1) - \mathbf{A}_{\mathbf{m}}(0)]\mathbf{B}_{\mathbf{d}}(0) \\ &+ \mathbf{w}(1)\overline{\mathbf{p}}_{\mathbf{m}}(1)\mathbf{A}_{\mathbf{m}}(1)[\mathbf{B}_{\mathbf{d}}(1) - \mathbf{B}_{\mathbf{d}}(0)] \end{aligned} \quad (8)$$

The first term of the right hand side stands for a factor of difference of the demand share between the period 0 and 1.

## 3 Imported Natural Resources Intensity

### 3-1 Overview

Figure 4 shows time series changes of Imported Natural Resources Intensity (INRI) by country. A country group where INRI is relatively high includes Japan, France, Netherlands, and Germany, while a country group where INRI is relatively low includes Canada (in latter period), the United States, United Kingdom, Denmark, and Australia. Generally, INRI is relatively low in a country that is abundant in domestic natural resources. Let us see time series changes of INRI. As to almost all of the countries, it is observed that INRI is on a downward trend during two decades after 1970. Among them large reduction is observed in such countries as Canada(0.0499→0.0137), Japan(0.0673→0.0360), France(0.0575→0.0283) and Denmark(0.0402→0.0177). The most remarkable is Canada where its INRI plunged to less than half between 1975 and 1980. To see time series change a little more in detail, we find that there is a temporary increase of INRI after the oil crisis in the USA and Netherlands. More interestingly, the INRI in these two countries is still higher than that before the oil crisis though the INRI is decreasing during 1980's.

As mentioned in the previous section, there are some factors that cause a change in INRI. So, in the next section, we will do a decomposition analysis to examine what kinds of factors caused such changes by country.

## 3-2 Decomposition analysis of INRI change by country

Figure 5 shows results of the decomposition analysis on INRI for Japan and the USA.

### 3-2-1 Japan

Japan's INRI decreased rapidly after the oil crises in 1970's. This is mainly because of improvement in both domestic goods input coefficients (technological change to save domestic intermediate goods) and imported goods input coefficients (technological change to save imported goods). The factor of change in composition of final demands has given little effect to the change of the INRI. However, relative importance of progress in domestic goods saving technology and imported goods saving technology was not necessarily same. While during 1970's the domestic goods input coefficient factor was larger, during 1980's, on the other hand, the imported goods coefficient factor was larger.

Since oil price was relatively stable during the late 1980's, the factor of change in imported goods input coefficients turns to be slightly positive. The change in domestic goods input coefficients, however, keeps negative. Therefore the overall change was still negative.

### 3-2-2 The USA

First of all, we need to be careful to evaluate the results of the decomposition analysis for the USA since available type of IO tables of constant prices in the USA are not of non-competitive type but of competitive type[3]. Therefore, the model specification might bring some biases to the results

In spite of high oil price the INRI became large during 1972 to 1977, which was mostly caused by increase in imported goods input coefficients. Contrastingly, during 1977 to 1982 the change in the INRI turned to be negative. Here too, change in imported goods input coefficients was a main factor. As a result, the level of the INRI returned to almost the same before the oil crisis.

To be sure, INRI of the USA was relatively low among OECD countries, but after 1980 the INRI of the USA was not in a decreasing trend where the change of each factor's was also marginal.  And it is quite characteristic that factor of change in domestic input coefficient in the USA have had limited effects compared with Japan.

## 4 Domestic Price Sensitivity to Imported Natural Resources Price

We estimated impacts of the price hike of imported natural resources on the domestic price structure, mainly focusing on Japan and the USA.

### 4-1 Change in domestic price and change in imported natural resource price

Figure 6a and Figure 6b show relations between each country's domestic price index and import price index of natural resources based on the OECD I-O database. Since the base year of the I-O tables are not same among countries, we separated the sample countries into two graphs.

The common features that we can observe from Figure 6a and Figure 6b are the following two points.

- There is a positive relation between domestic price and imported natural resource price and the slope is flatter than 45 degree line.
- After 1980's the curve makes a backward bending where domestic price hardly reacts with decline in imported natural resource price.

Those observations suggest that before 1980's the relative importance of imported natural resource as an intermediate input decreased large so that price decline after that could not decrease the general domestic price.

Figure 7a and Figure 7b show impact that imported natural resources price 100% hike will give on each country's general domestic price.  The shape of line graphs are of reverse V for most of countries though the place of the peak is considerably different among countries.  It was Japan that was the most vulnerable to change in imported natural resources price.  The Japanese Domestic Price Sensitivity to Imported Natural Resources Price (DPSINRP) started 3.8% in 1970 and reached in 1980 the peak of 8.2% that is twice as high as that of Netherlands, the second highest. But after this peak Japanese DPSINRP that decreased widely to 2.3% in 1990  Other countries such as Canada, Netherlands, France, Denmark, and the United States basically follow the same path.  However, the most notable in the Japanese case is that the ending point is much lower than the starting point, which means Japan's economy became more resilient to the external shock.

As mentioned above, the basic trend in the USA was similar to that observed in Japan. However, there are some differences. First of all, the level of sensitivity itself is much lower than that for Japan. The peak of the US case is no more than 2% that is even lower than the lowest point in the Japanese vase. Secondly, the US sensitivity started to fall at the beginning of 1980's. And thirdly, the ending point is not as low as the stating point that is before the oil crisis.

## 4-2 Decomposition analysis of Domestic Price Sensitivity

Figure 8 indicates decomposition of changes in DPSINRP for Japan and the USA.

### 4-2-1 Japan

Japanese DPSINRP increased during 1970-75 and 1975-80. Looking at the decomposition factor, the one that boosts most was the initial price level of imported resources. The simulation in this section assumes 100% price hike of imported natural resources, so if the initial level of the price is different, the magnitude of the impact is also different. Concerning on domestic input coefficient factor, in the first half of the 1970s, it boosted DPSINRP, while in the second half of the 1970s including the second oil crisis it decreased DPSINRP. After 1980 the almost all factors worked as a decreasing factor where in the first half of 1980s the factor of import input coefficient was the largest portion of change in DPS, and the factor of domestic input coefficient was second. It is interesting to say that in the latter half of 1980s the initial price level factor dominated the largest portion because of so-called 'reverse oil shock'. As is well known, Japan is poor in natural resources so that the economic success was thanks to cheap price of natural resources before the oil crisis. Higher prices of natural resources made Japanese economy reduce high dependency on imported natural resources. The import coefficient change, which reduced DPS after the oil crisis, is a reflection of the development in resources saving or energy-saving technologies.

### 4-2-2 the USA

The trend of DPSINRP in the USA is same as that in Japan while the magnitude of change in the USA is smaller than that in Japan. Another difference between Japan and the USA is technological factors; in Japan the factor of domestic coefficient is relatively large while in the USA the factor of import coefficient is relatively large.

In other words, Japan adjusted both inputs of domestic and imported intermediate goods against price change in import natural resources while the USA mainly adjusted inputs of imported intermediate goods. It is because a country such as the USA where natural resources are comparatively abundant can substitute imported goods for domestic resources to some degree. In that sense, the domestic production input coefficient does not change so much because the amount of domestic input goods can increase in the face of higher natural resources prices. On the other hands, Japan cannot substitute import resources for domestic input goods, so Japan has no choice but to save natural resources by technological development.

## 5 Preliminary Conclusions

From the analysis on imported natural resource intensity, Japan's INRI decreased rapidly after the oil crises. This is mainly because of the changes in domestic goods input coefficients and in imported goods input coefficients. On the other hand, the U.S. INRI has been quite low and rather stable overtime in comparison with Japan. A change in imported goods input coefficients was a main factor of a change in INRI for the USA and a change in domestic coefficient have had limited effects.

The results from DPS analysis are in line with the intensity analysis. In Japan, change in DPS was mainly caused by a change in import input coefficient. The trend of DPS in the USA is same as that in Japan though its magnitude is smaller than that in Japan. Another feature is that in Japan the factor of domestic input coefficient is relatively large while in the USA the factor of import coefficient is relatively large. In other words, Japan has adjusted both inputs of domestic and imported intermediate goods against shocks in import natural resources while the USA mainly adjusted inputs of imported intermediate goods.

As me mentioned in Introduction, we often hear that in the USA the greater efficiency in the use of energy has dampened the macro economic impacts of rising oil prices. Against these opinions, professor L.R. Klein et al criticized in their recent paper[4]. They calculated the effect of the exogenous change in oil price on the overall price level by using the time-series U.S. IO tables. According to their calculation result, overall price sensitivity to change in crude oil price remained almost unchanged except the period of the oil crisis[5]. They concluded that one should not assume that the economy, at least as far as inflation pressures are concerned, is now less sensitive to fluctuations in crude oil prices. Their results are in line with our calculation. However, it should be noted that the direction of change in the price sensitivity is the same pattern as our research works but the level is different. There are some possible reasons for the difference in calculation results. First, industrial classification is somewhat different. Second, we deal with domestic goods price and imported goods price in a different way by using non-competitive IO tables. But anyway, we can say Japan's economy has become much more resilient to a price shock of imported natural resources, and the present US economy has not been less sensitive to a price shock compared with the US economy before the oil crisis.

## Appendix Model with competitive type of IO table

As to fixed price tables, only IO tables of competitive type are available for analyses on the US economy. Since input coefficient by each cell is unknown, it is usually assumed that the cells in the same row are same. Based on this assumption, the supply-demand balance expressed as equation (A-1).

$$\mathbf{x} = [\mathbf{I} - (\mathbf{I} - \mathbf{M})\mathbf{A}]^{-1}[\mathbf{e} + (\mathbf{I} - \mathbf{M})\mathbf{f}] = \mathbf{B}\mathbf{f_d} \tag{A-1}$$

where $\mathbf{M}$ is a diagonal matrix whose each element is an import ratio of the corresponding sector. The induced import by one unit of final demand is expressed by the equation (A-2).

$$\overline{\mathbf{m}} = \mathbf{MAB}\bar{\mathbf{f}} \tag{A-2}$$

In case we have two IO tables for the periods 0 and 1, overtime change in the induced imported inputs is expressed by equation (A-3).

$$\begin{aligned} d\overline{\mathbf{m}} &= \overline{\mathbf{m}}(1) - \overline{\mathbf{m}}(0) \\ &= [\mathbf{M}(1)\mathbf{A}(1) - \mathbf{M}(0)\mathbf{A}(0)]\mathbf{B}(1)\bar{\mathbf{f}}(1) \\ &\quad + \mathbf{M}(0)\mathbf{A}(0)[\mathbf{B}(1) - \mathbf{B}(0)]\bar{\mathbf{f}}(1) + \mathbf{M}(0)\mathbf{A}(0)\mathbf{B}(0)[\bar{\mathbf{f}}(1) - \bar{\mathbf{f}}(0)] \end{aligned} \tag{A-3}$$

The first term of the right hand side is a factor of change in import input coefficients, the second term is a factor of change in Leontief inverse (or domestic input coefficients), and the third term is a factor of change in final demand composition.

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a) Konan University, Faculty of Economics, fujikawa@konan-u.ac.jp
b) Konan University, Faculty of Economics, inada@konan-u.ac.jp
c) Tezukayama University, TIES development center, shimoda@tezukayama-u.ac.jp
d) Aichi-Gakuin University, Faculty of commerce, twata@dpc.aichi-gakuin.ac.jp

1 For example, the Chairman of FRB, Alan Greenspan said in the lecture for the Japan Business Federation on 2005 October 17 at Tokyo, Japan, “Moreover, since oil use, as I noted, is only two-thirds as important an input into world GDP as it was three decades ago, the effect of the current surge in oil prices, though noticeable, is likely to prove significantly less consequential to economic growth and inflation than the surge in the 1970s.”
http://www.federalreserve.gov/boarddocs/speeches/2005/20051017/default.htm

2 IEA(2004) projects that if Oil prices are assumed to be $10 per barrel higher than in base case, the OECD GDP will be 0.4% lower than the base case, while Asian Development Bank projects the Asian GDP will be 0.5% lower than the base case under the same assumption.

3 As for the model based on non-competitive type IO table, see the Appendix.

4 Lawrence R. Klein, Vijaya G. Duggal and Cynthia Saltzman, 2005.

5 Percent change in overall prices induced by a 10 percent changes in the price of crude oil are as follows: 0.316 in 1972, 0.700 in 1977, 1.049 in 1982, 0.380 in 1987, 0.375 in 1992, 0.334 in 1997 and 0.365 in 2003.

Figure 1 CIF price of crude oil

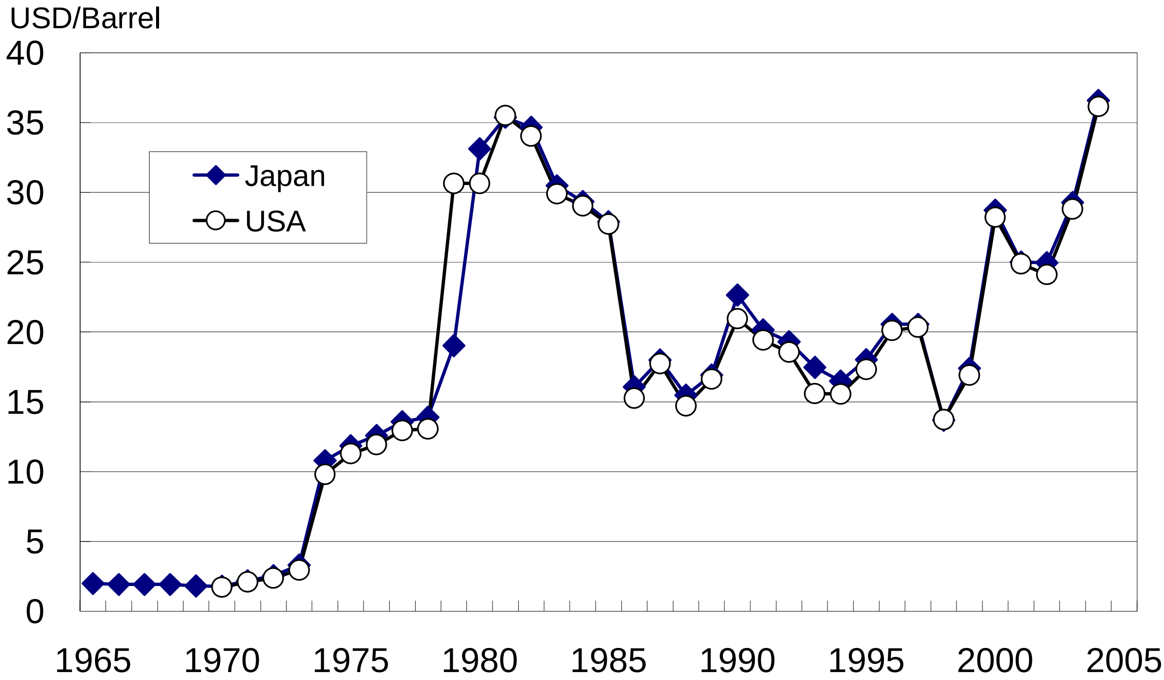


Figure 2 Final energy consumption to real GDP in terms of PPP

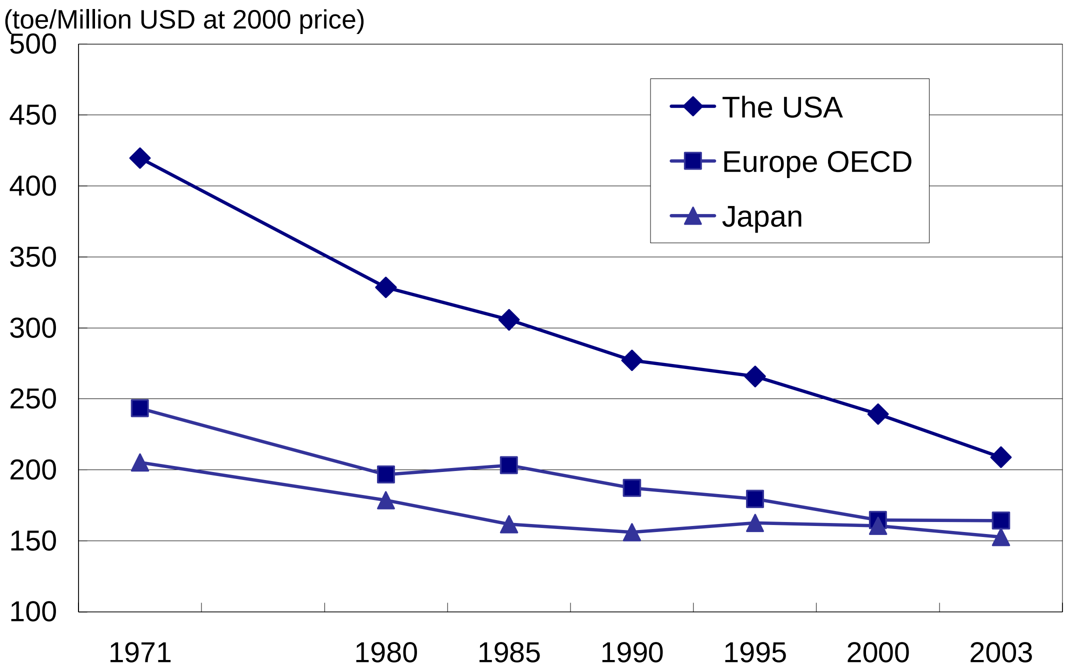

Figure 3 GDP and Primary Energy Consumption in China and India

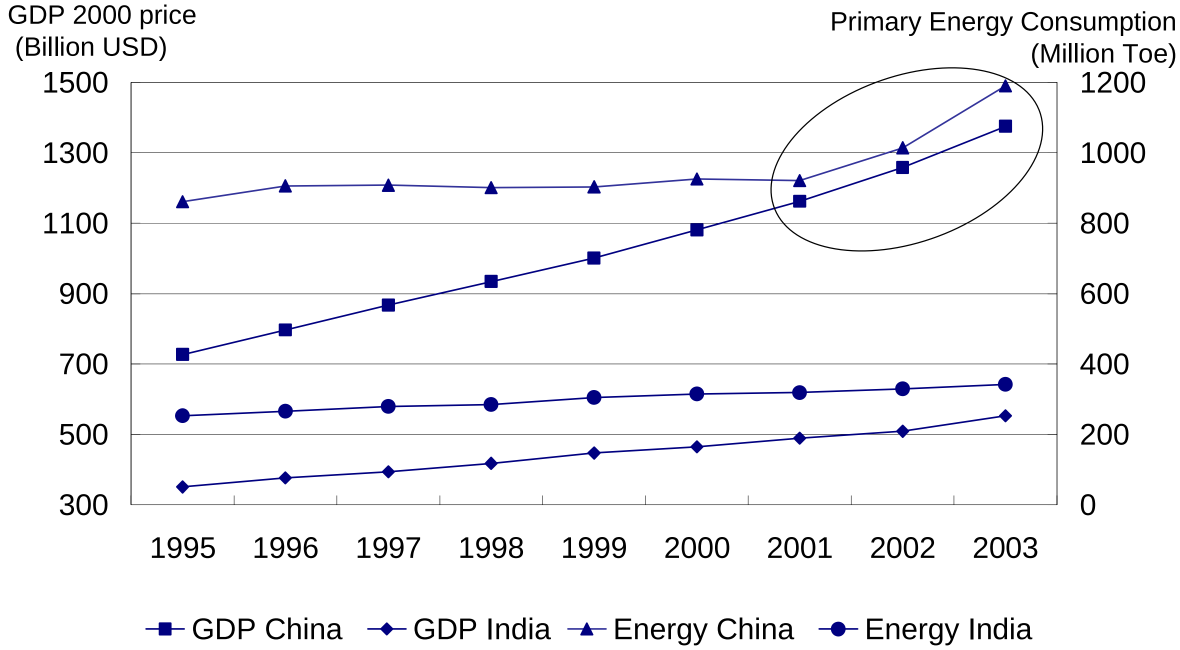


Figure 4 Imported natural resources intensity

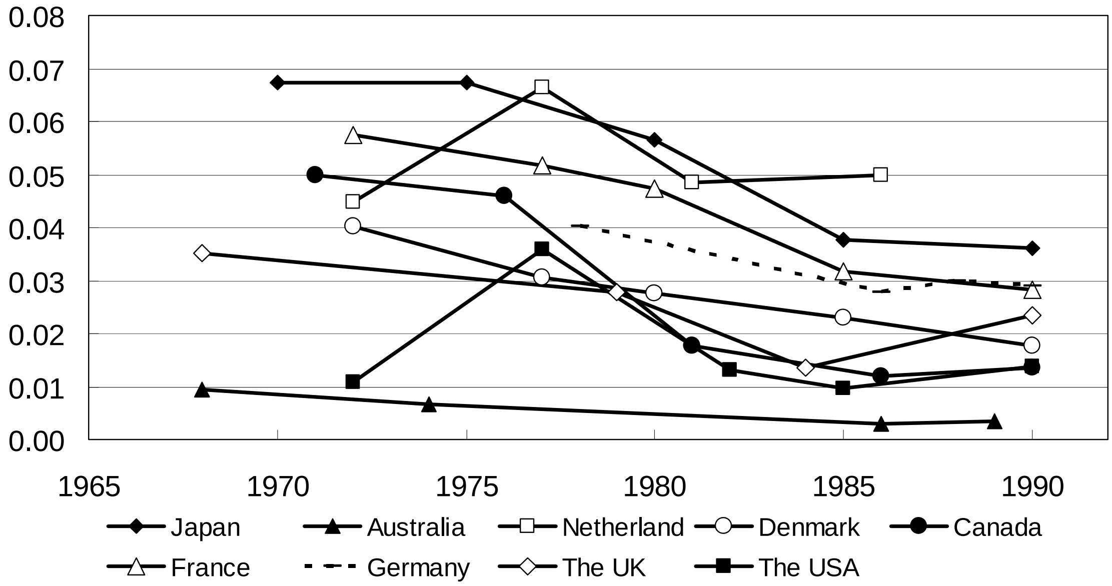

Figure 5 Decomposition of Changes in INRI for Japan and the USA

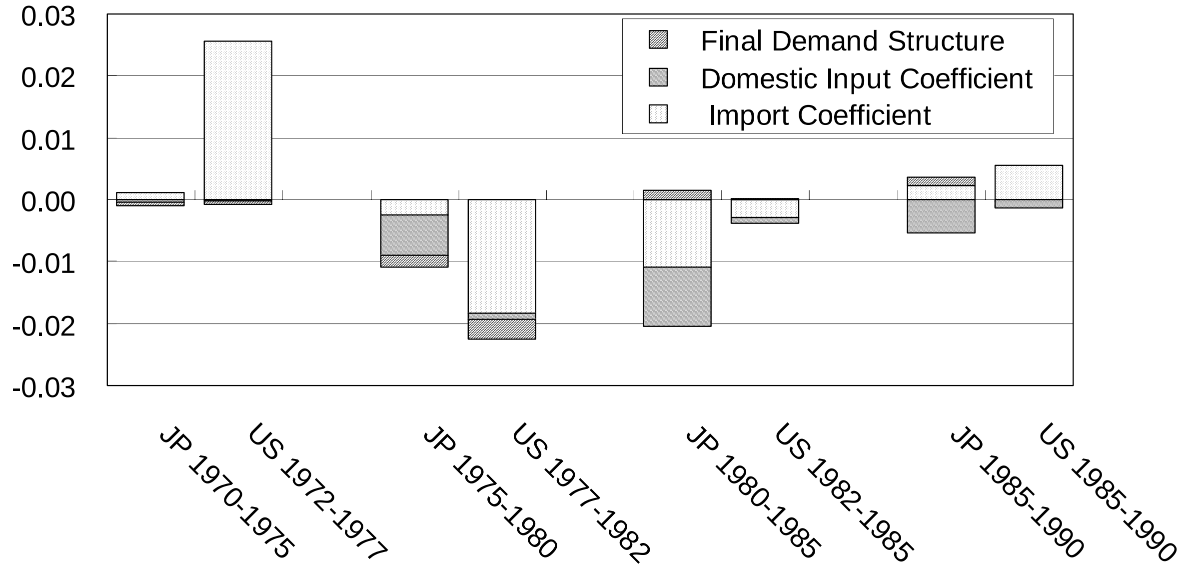


Figure 6a Domestic Price and Imported Natural Resource Price a

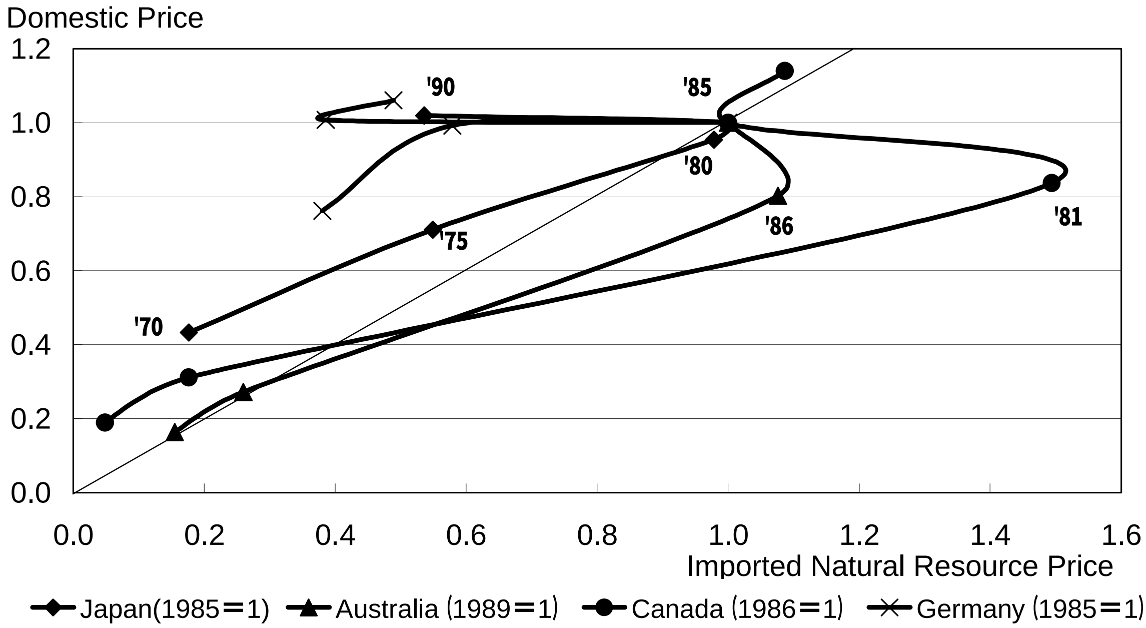

Figure 6b Domestic Price and Imported Natural Resource Price b

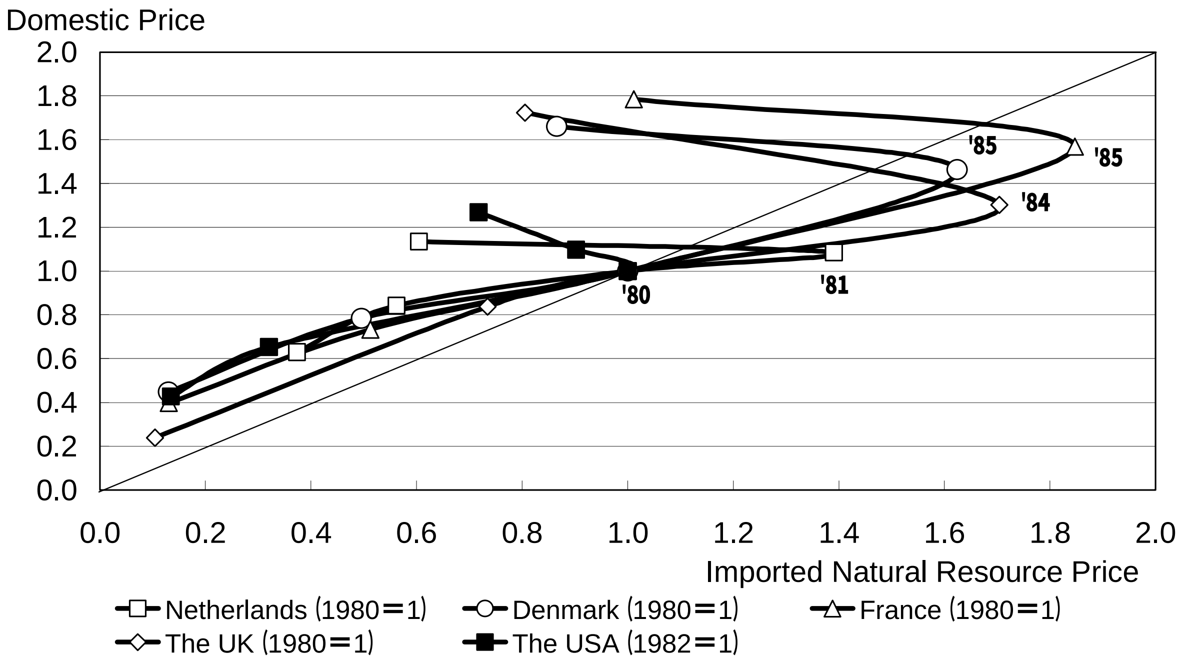


Figure 7a Impact of INR price 100% hike on domestic price a

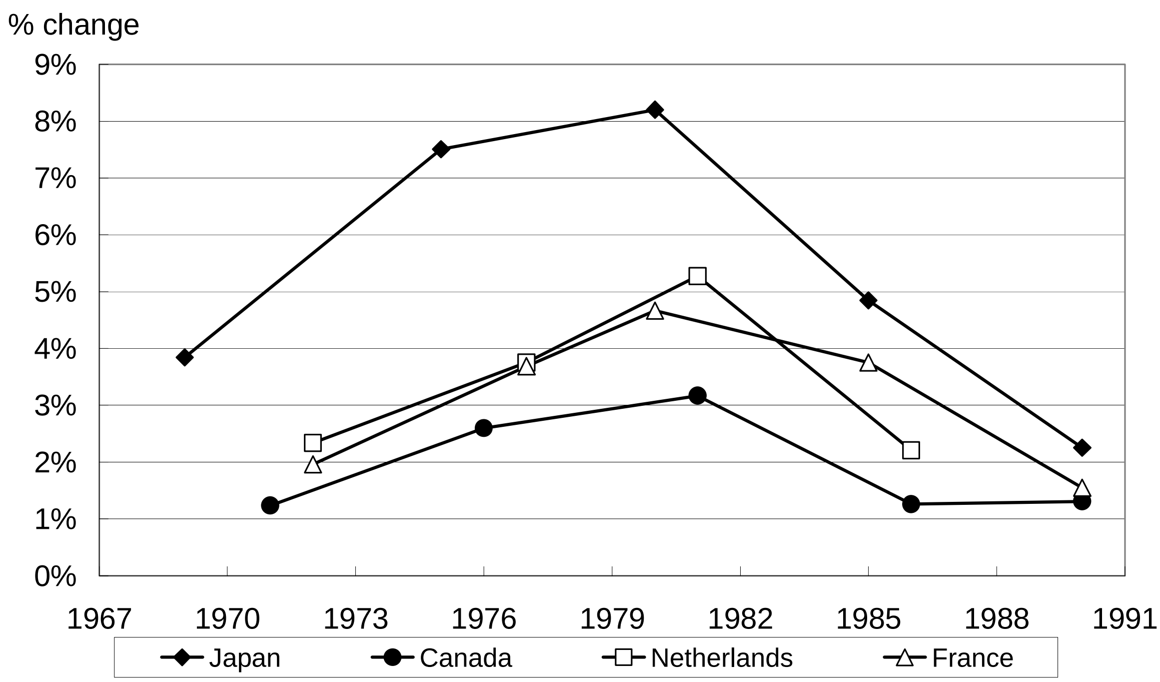

Figure 7b Impact of INR price 100% hike on domestic price b

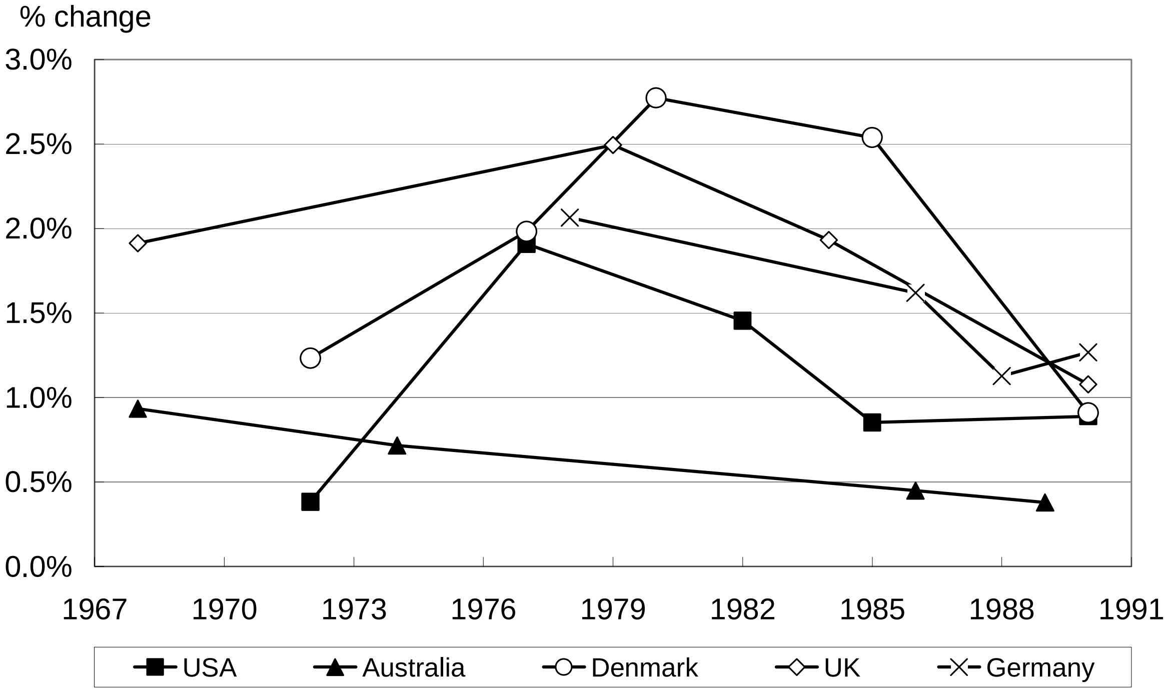


Figure 8 Decomposition of Changes in Domestic Price Sensitivity (Japan & USA)