# OPTIMAL PRICING OF PETROLEUM PRODUCTS WITH BUDGET CONSTRAIN AND EXTERNALITY

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**SUMMARY**

This paper identifies the sources contributing to energy price distortion prevailing in Taiwan. These include market structure distortion, price distortion, taxation distortion, and cost distortion. A Ramsey pricing rule is developed that takes into account the environmental externalities generated by energy consumption. Empirical results indicate that the current price structure should be adjusted substantially to meet the objectives of Ramsey goals. The economic impacts from implementing the Ramsey pricing rule are evaluated by using the Dynamic Taiwan General Equilibrium Model (TAIGEM-D). The model is also used to evaluate the economic impacts of eliminating tariffs on imported energy as well as the market structure distortion.

## 1. INTRODUCTION

Pricing policy of petroleum in Taiwan used to be intimately attached to the general energy policy of that the goals vary across time. Historically speaking, the energy policy in Taiwan could be divided into five phases with specific goals in each. The main goal in the first phase (1968-72), as stated in the Principles of Energy Development in Taiwan Area, was to stabilize oil supply at low price so as to minimize cost burden on the industrial sectors that played critical role in pursuing economic growth. In response to the first world energy crisis, the Energy Policy in Taiwan Region (EPTR) was promulgated at the beginning of the second phase (1973-78). While continuing to focus on the stabilization of supply and prices, the energy policy in this phase emphasized more on supply diversification and storage safety. Significant policy changes were observed in the third phase (1979-83) during which demand-side management received more attention than ever before, with particular emphasis on energy saving. Meanwhile, the authority also encouraged shift of consumption from oil to coal with an aim to reduce domestic dependence on imported oil that had remained expensive and highly uncertain in supply due to the second energy crisis. Production targets were first suggested for domestic oil and natural gas to substitute imported oil. Not until the fourth phase (1984-89), environmental protection and ecological conservation for the first time became major concerns of the energy policy. Not only various incentives were provided to enhance abatement technology and fuel quality, but also energy efficiency standards were regulated for buildings, energy-related facilities and equipments, etc. The government on the one hand encouraged bilateral collaboration with foreign countries for coal exploration in the hope of securing supply, and, on the other hand, discouraged development of energy intensive industries. EPTR was substantially amended to launch new policy goals underlying the fifth phase starting from 1990. The amendment covers several innovative strategies such as increasing import of LNG for power generation, promoting co-generation and market liberalization, establishing transaction system for electricity, extending environmental concerns from domestic pollution to global pollution, etc. In brief, the new EPTR outlined policy guidelines with the following goals: (1) to ensure stable supply of energy, (2) to rationalize energy prices, (3) to increase efficiency of energy use, (4) to control environmental pollution, (5) to enhance R&D, and (6) to implement education and media demonstration.

Ten years after the implementation of the new EPTR, there remains much room of improvement as far as energy pricing and pollution control are concerned. Despite the success in stabilizing energy price over decades, the prices remain highly distorted for several reasons:

(1) *Market structure distortion*. Petroleum market used to be monopolized by the Chinese Petroleum Corp (CPC), a government owned and operated enterprise. Under the legal requirement for surplus, the mark-up pricing rule has been in practices for decades. It is well known that the mark-up pricing rule is unlikely to achieve Pareto optimality, especially in a monopolistic market.

(2) *Price distortion*. To protect certain groups of people, organizations and enterprises, various subsidiary measures were provided for a number of petroleum commodities and natural gas (see Table 1). Although emission fee has been levied on petroleum products to internalize environmental cost, prevailing prices are considered highly distorted on the grounds of efficiency and distributional effects.

(3) *Taxation distortion*. Market distortion also originates from prevailing taxation schemes. The government levies such charges as tariff, harbor construction fee, commodity tax, emission fee, and value-added tax on petroleum commodities at discriminative basis. As an example, the commodity tax was NT$6,500 for petroleum, NT$3,800 for diesel oil, and only NT$100 for fuel oil for industrial uses.

(4) *Cost distortion*. Just as other government operated enterprises, so is CPO criticized for its inefficient management and excessive hidden costs that become another source of distortion. The price based on the unit cost will be inflated to some extent as cost is inefficient, and thereby imposes too much burden on those who are already over paying.

As market liberalization is becoming the main stream and the general public is much more concerned about the welfare effects of current pricing rule, it is imperative to consider alternative pricing rules that could achieve both welfare maximization and budget balance. For this purpose, Ramsey pricing rule is proposed. Despite Ramsey pricing is well known, its integration with environmental externalities, however, is less satisfactorily developed, especially when multiple pollutants are generated from petroleum consumption. Emission fee is the typical instrument to internalize environmental externality. Nevertheless, the fee was set independently from the energy authorities by EPA without resorting to the energy market and emerging need for budget balance in energy pricing. Consequently, not only the emission fee is problematic in terms of its potential divergence from the socially optimal level, but also such an *ad hoc* addition of the emission fee to the petroleum price set by CPC can hardly lead to a Ramsey price that effectively internalizes externalities.

Table 1. Subsidiary measures for petroleum commodities and natural gas in Taiwan

1. *Subsidy on fishing boat fuel*

   (a) Motor fuels for agricultural and fishery uses shall be exempt from business tax (Article 8, Business Tax Law).
   (b) Fuels used for designated fishery boats (namely, Type A and Type B) shall be exempt from commodity tax (Article 59, Fishery Law).
   (c) The Council of Agriculture provides unit subsidy to the fuel used by fishery boats of Type A and Type B. It was US$31 per kiloliter for Type A in 2002/9 to 2003/8 and US$11 for Type B in the same period.

2. *Subsidy on Taiwan Fertilizer Co., Ltd.* (TFC)

   The natural gas and oils purchased by TFC may be provided by CPC at special rates. The difference between the special rate and the market price shall be absolved by CPC.

3. *Subsidy on military organizations and facilities*

   (a) All commodities supplied for military uses are exempt from commodity tax (Article 3, Commodity Taxation Act).
   (b) All petroleum sold to military organizations and facilities are 20% off.

4. *Subsidy on CPC's employees*

   All employees are entitled to the wholesale price offered by CPC to the gas stations.

5. *Subsidy on power generation facilities and rail transportation*

   (a) Diesel oil for power generation is 5% off the regular diesel oil.
   (b) Diesel oil for rail transportation is 20% off the regular diesel oil.
   (c) The price of fuel with low sulfur content supplied to Taiwan Power Company (TPC) is lower than that to other buyers

6. *Subsidy for Natural Gas*
   (a) Natural gas sold to the co-generation systems has a preferential rate amount to 97.5% of the price of the gas for industrial uses. (Article 12, Act of Co-Generation System Extension)
   (b) The price of natural gas sold to TFC and Taiwan Power Company (TPC) shall be below the average cost incurred by CPC.
   (c) All employees are entitled to the best discount available to the dealers of the natural gas commodities.

Source: Huang et al. (1998).

The purpose of this paper is to develop a Ramsey pricing rule that explicitly takes into account the environmental cost due to energy consumption. Meanwhile, the Dynamic Taiwan General Equilibrium Model (TAIGEM-D) is developed to evaluate the economic effects from removal of various distortions. The paper is arranged as follows. A Ramsey pricing model with budget balance and externality is established and empirically estimated in section two. Major features of TAIGEM-D are described in section 3. The effects of various types of distortion removal on the economy are reported in section 4, that include tariff reduction, market distortion, and price distortion.

## 2. RAMSEY PRICING WITH EXTERNALITIES

Pricing rules suitable to petroleum products includes marginal cost pricing, average cost pricing, mark-up pricing, etc. As well documented in the literature, the marginal cost pricing is considered as most efficient in the case without environmental externality. Problems arise when the firm such as CPC is characterized by increasing returns to scale since profit deficit is inevitable. In contrast, the average cost pricing, while able to assure budget balance, could suffer from welfare loss. Ramsey pricing rule is regarded as the second best since it maximizes social welfare while meeting the requirement of budget balance.

Although Ramsey pricing rule is well known in the case without externality, it is not so obvious when environmental cost resulting from petroleum consumption must be taken into account. In this section, Ramsey prices with and without externality are derived under the circumstance that a monopolistic firm produces multiple petroleum products, each of which is characterized by separated market demand.

Assume there are *m* petroleum commodities denoted by a commodity vector $o = \{o_1, o_2, o_3, ........., o_m\}$. Price vector of the commodities is denoted by $P = \{P_1, P_2, P_3, .........., P_m\}$ and the inverse market demand functions by:

$$P_j = P_j\left(o_j^D\right), \; j=1,\ 2, \ldots,\ m.$$

The production of commodities is characterized by an aggregated cost function as follows:

$$TC = TC(o^S),$$

where $o^S$ represents supply vector.

As such, the Ramsey prices could be obtained by solving the following maximization problem:

$$\text{Max} \;\; TW = \sum_{j=1}^{m} \left\{ \int_0^{o_j} P_j\left(o_j^D\right) do_j^D - o_j^D \cdot P_j \right\} + \sum_{j=1}^{m} P_j\left(o_j^D\right) o_j^D - TC\left(o_j^S, o_2^S, o_3^S, ......., o_m^S\right)$$

$$\text{Subject to;} \quad \sum_{j=1}^{m} P_j\left(o_j^D\right) \cdot o_j^D = TC\left(o_1^S, o_2^S, o_3^S ......., o_m^S\right), \tag{1}$$

$$o^D = o^S, \tag{2}$$

where equations (1) and (2) represent, respectively, the budget balance constraint and market equilibrium condition.

The ultimate solution is given by the following familiar equation:

$$P_j = \left( \frac{E_j \cdot (1 - \lambda)}{E_j \cdot (1 - \lambda) - \lambda} \right) MC_j\left(o_j^S\right), \tag{3}$$

where $E_j = (P_j / o_j)(\partial o_j / \partial P_j) < 0$ and $\lambda$ represent, respectively, the price elasticity of demand and the Lagrangean multiplier associated with equation (1). As revealed by equation (3), Ramsey price is in principle less than the marginal cost and varies in opposite direction with price elasticity of demand.

Now let's consider the environmental cost caused by the emissions due to commodity consumption. Let $e = \{e_1, e_2, e_3, ......., e_m\}$ represent the emission vector and the emission from each commodity is proportional to its consumption (that is, $e_j = a_j \cdot o_j$ , where $a_j$ is the emission coefficient). The damage cost function is given by $DC(e_1, e_2, e_3, ......., e_m)$. Hence, the Ramsey price with externality can be obtained by solving the following problem:

$$\text{Max} \;\; L = \sum_{j=1}^{m} \int_0^{o_j} P_j\left(o_j^D\right) do_j^D - TC\left(o_1^S, o_2^S, o_3^S, \ldots\ldots, o_m^S\right) - DC\left(e_1, e_2, e_3, \ldots\ldots, e_m\right)$$

Subject to: Equations (1) and (2).

Solving the above problem leads to the following result:

$$P_j^e = \left(\frac{E_j \cdot (1-\lambda)}{E_j \cdot (1-\lambda) - \lambda}\right)\left[MC_j\left(o_j^S\right) + \frac{a_i}{1-\lambda} MDC_j\right], \qquad (4)$$

where $MDC_j$ represents the marginal damage cost caused by pollutant *j*.

Equation (4) indicates that the optimal emission fee to be added to each commodity is quite different from the traditional Pigovian tax that is identical to the marginal damage cost (MDC). It could be greater, equal, or less than MDC, depending on the values of emission coefficient and price elasticity. Proposition 1 illustrates the sufficient condition under which the optimal emission fee should be greater than MDC. Comparison between equations (3) and (4) reveals the Ramsey price with is always greater than that without externality.

***Proposition 1***. If $\lambda \geq (1-a)E/(1+E)$, then the optimal emission fee should be greater than MDC.

Equation (4) does not give us the explicit solution of the Ramsey price since the multiplier $\lambda$ is also unknown. To get the explicit solutions for the Ramsey prices as well as the multiplier, one needs to solve the simultaneous system that consists of equation (4) and equation (1), where price elasticities, emission coefficients, and marginal damage cost are exogenous and must be obtained from other sources.

For simplicity, we consider only four commodities, namely, gasoline ( $j=1$ ), diesel oil ( $j=2$ ), fuel oil ( $j=3$ ), and natural gas ( $j=4$ ). The estimates of price elasticities are adopted from Yu et al. (1989) as shown in Table 2. The marginal damage cost (*MDC*) of each commodity is approximated by its emission fee for $SO_2$ emission. To avoid the potential bias resulting from measurement error of *MDC*, we conduct a sensitivity analysis to examine how the Ramsey prices change in response to changes in *MDC*. As for the marginal cost of each commodity, no data is readily available from CPC. Instead, the average cost (*AC*) is used as a proxy. Due to the aggregation properties of the cost data, the total cost is allocated to each of the four commodities in proportion to its share of product value (i.e., $AC_j = \alpha_j \times TC\left(o_1^S, o_2^S, o_3^S, o_4^S\right)$, where $\alpha_j$ is the share of product value of commodity *j*.

The Ramsey prices of the four commodities are reported in Table 3 and depicted in Figure 1. The results suggest that both gasoline and diesel are currently under priced, while natural gas is over priced. Whether or not the fuel oil is under price has something to do with the magnitude of *MDC*. Unless MDC is sufficiently high, there is a room to adjust downward the price of fuel oil since the existing price is greater than the Ramsey price in most cases of MDC. Furthermore, the value of the multiplier ( $\lambda$ ) increases with MDC, implying that the social opportunity cost of every dollar increase in the firm's revenue will increase as pollution becomes more environmentally damaging.

Table 2. Own price elasticities and cross price elasticities for petroleum commodities

| | Gasoline | Diesel | Fuel oil | Others |
|---|---|---|---|---|
| Gasoline | -1.6817 | 0.2487 | 1.4258 | 0.0076 |
| Diesel | 0.1533 | -1.0084 | 0.8508 | 0.0043 |
| Fuel oil | 0.2531 | 0.2449 | -4.6690 | 0.0042 |
| Others | 0.2136 | 0.1956 | 0.6562 | -1.0655 |

Source: Yu et al. (1989).

Table 3. Ramsey prices of selected petroleum commodities under different MDC

| Ramsey prices | MDC | | | | | Actual price before tax |
|---|---|---|---|---|---|---|
| | 1 | 2 | 5 | 10 | 100 | |
| Gasoline ($P_1$) | 20,757.4 | 20,739.5 | 20,685.5 | 20,593.2 | 18,247.6 | 11,880 |
| Diesel ($P_2$) | 14,833.9 | 14,811.8 | 14,745.0 | 14,632.1 | 12,142.8 | 10,680 |
| Fuel oil ($P_3$) | 5,188.6 | 5,209.0 | 5,270.8 | 5,375.6 | 7,855.7 | 7,567 |
| Natural gas ($P_4$) | 9,032.8 | 9,024.3 | 8,998.7 | 8,955.0 | 7,875.4 | 10,776 |
| $\lambda$ | 0.00296 | 0.00593 | 0.01486 | 0.02984 | 0.3302 | ---- |

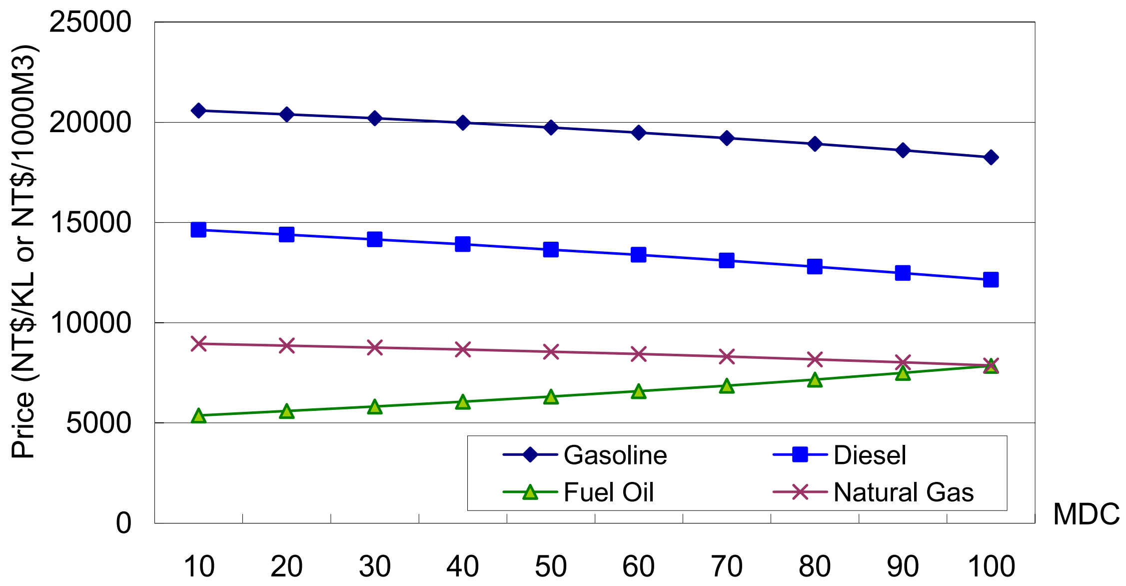


Figure 1. Sensitivity of Ramsey prices of selected petroleum commodities to MDC

## 3. Overview of TAIGEM-D

We have observed the divergence of existing prices from the Ramsey prices that may result from the distorting measures reported in Table 1. To investigate the impact of such a divergence on the economy, we establish a dynamic computable general equilibrium model, called "Dynamic Taiwan General Equilibrium Model (TAIGEM-D)".

TAIGEM-D is developed specifically to evaluate climate change policies. It is a multisectoral CGE model of the Taiwan's economy modified from ORANI (Dixon, Parmenter, Sutton and Vincent, 1982). The input-output database was compiled from the 150-sector Use Table of the 1994 Taiwan's Input-Output tables. TAIGEM-D distinguishes 160 sectors, 6 types of labor, 8 types of margins and 170 commodities and is characterized by several important features such as interfuel substitution, technology bundles and dynamic mechanism that allows us to project the baselines of critical variables , e.g., $CO_2$ emission, GDP growth rate, and other economic variables.

– **Dynamic mechanism**

According to Dixon and Parmenter (1996), dynamic mechanisms of CGE model may be categorized into four broad cases, namely (1) exogenous investment, a recursive model, (1) endogenous investment but still recursive, (3) a non-recursive multi-period model, (4) a non-recursive multi-period model with optimizing investment behavior.

In Case 1 investment is exogenous. In Case 2, investment and capital accumulation in year t+1 depend on expected rates of return for year t+2, which we assume are determined by actual returns to and costs of capital in year t+1. In both Cases 1 and 2, the models are recursive, i.e., they can be solved for year 1 and then for year 2 and so on. In Case 3 expected rates of return for year t+2 are assumed to be equal to the actual rates of return for year t+2, namely, expectations are rational or consistent. In Case 4, the behavior of investors is explicitly optimizing. Relative to the recursive models in Cases 1 and 2, solution of Cases 3 and 4 models require a more sophisticated computational approach for handling the computations for all of the years simultaneously.

For the forecasting and policy simulations in TAIGEM-D, we solve a large (160 industry) recursive model incorporated externally supplied, realistic macroforecasts. That is, our approach is an application of Case 2. A dynamic model such as TAIGEM-D is beneficial when analyzing climate change policies since the timing of policy implementation and the adjustment path an economy follows are highly relevant in the climate change policy debate.

– **Structure of Production: Non-Electricity Sectors**

TAIGEM-D also allows each industry to produce several commodities and to use domestically produced and imported inputs, including labor of several types, land, capital, energy of several types, and "other costs". In addition, commodities destined for export are distinguished from those for local use. To keep the multi-input and multi-output production specification manageable, TAIGEM-D imposes a series of separability assumptions. The underlying production structure of the non-electricity sectors is illustrated in Figure 2.

The input demand of industry production is formulated by a five-level nested structure, and the production decision-making of each level is independent from one to another. Given cost minimization and technology constraint at each level of production, the producer will choose optimal demands of inputs. At the top level, commodity composites and a primary-factor composite are combined using a Leontief production function. Consequently, they are all demanded in direct proportion to the industry activity. At the second level, each commodity composite is a CES (constant elasticity of substitution) function of domestic goods and the imported equivalent (the Armington assumption). Energy and primary-factor composites are a CES aggregation of energy composites and primary-factor composites.

At the third level, the primary-factor composite is a CES aggregation of labor, land, and capital, and the energy composite is a CES aggregation of coal products composites, oil products composites, natural gas products composites, and electricity. At the fourth level, the labor composite is a CES aggregation of managers, professional specialists, white collar, technical, workers, and unskilled workers; the coal products composite is a CES aggregation of coal and coal products; the oil products composite is a CES aggregation of gasoline, diesel oil, fuel oil, and kerosene; the natural gas products composite is a CES aggregation of refinery gas, gas, and natural gas. At the bottom level the energy composite is a CES aggregation of domestic goods and imported goods.

Like ORANI model, the output structure of TAIGEM-D allows each industry to produce a mixture of all the commodities. Moreover, conversion of an undifferentiated commodity into goods destined for export and local use is governed by a CET (constant elasticity of transformation) transformation frontier.

– **Technology Bundle in Electricity Sector**

In TAIGEM-D the production in the electricity sector adopts the "technology bundle" approach embeded from Australia ORANI-E and GTEM. With this approach, electricity can be generated from coal, petroleum, gas, nuclear, hydo or renewable energies. The electricity industry is able to substitute between technologies in response to changes in their relative costs. By modeling energy intensive industries in this way, TAIGEM-D restrict substitution to known technologies, thereby preventing technically infeasible combinations of inputs being chosen as the model solutions. While retaining the extensive interaction with other sectors of the economy obtained in "top down" models, TAIGEM-D moves further toward the realism of the "bottom up" approach.

The way in which the technology bundle approach ensures that the pattern of input use is consistent with known technologies is illustrated in Figure 3. TAIGEM-D incorporates ten technologies that are currently used to generate electricity, namely hydro, stream turbine-oil, stream turbine-coal, stream turbine-gas, combined cycle-oil, combined cycle-gas, gas turbine-oil, gas turbine-gas, diesel, and nuclear. All electricity generated from these technologies is transferred to the end-use electricity sector. The output of the electricity sector is a CRESH aggregate of each electricity technology, and this technology requires fixed proportions of intermediate inputs, with the exception of energy inputs and primary factors.

## 4. EFFECTS FROM DISTORTION ELIMINATION

In this section, we evaluate the economic impacts of three measures aiming at reducing price distortion of petroleum, including (a) elimination of the tariff on imported energy, (b) elimination the market structure distortion, and (c) internalization of environmental cost.

– **Eliminating Tariff of imported energy**

In this simulation, tariffs on coal, petroleum, natural gas, gasoline, diesel, and fuel oil are reduced, respectively, by 0%, 2.44%, 4.76%, 13.04%, 4.76% and 4.76%. The impacts on macroeconomic variables (e.g., GDP. CPI, terms of trade, utility per capita, and $CO_2$ Emissions) are reported in Figure 4.

– **Eliminating market structure distortion**

In the past decades, energy price in Taiwan has been moving in similar pattern as the United State. To measure the distortion of market structure, we assume the U.S. energy market is competitive and use it as a benchmark. Therefore, to eliminate market structure distortion implies that the energy prices in Taiwan must be reduced to the levels prevailing in the U.S. The actual data reveals that the price of stream coal, natural gas, unleaded gasoline, diesel, and fuel oil should be reduced, respectively, by 56.59%, 40.17%, 44.83%, 21.36% and 13.48%. The impacts on macroeconomic variables are reported in Figure 5.

– **Ramsey pricing**

This simulation follows the Ramsey pricing rule in Section 2. The existing prices of gasoline and diesel are, increased, respectively, by 70.56 and 35.81%, while the prices of natural gas and fuel oil decreased by 16.18% and 31.02%, respectively. The impacts on macroeconomic variables are reported in Figure 6. The impact of each distortion correction on industries is summarized in Table 7.

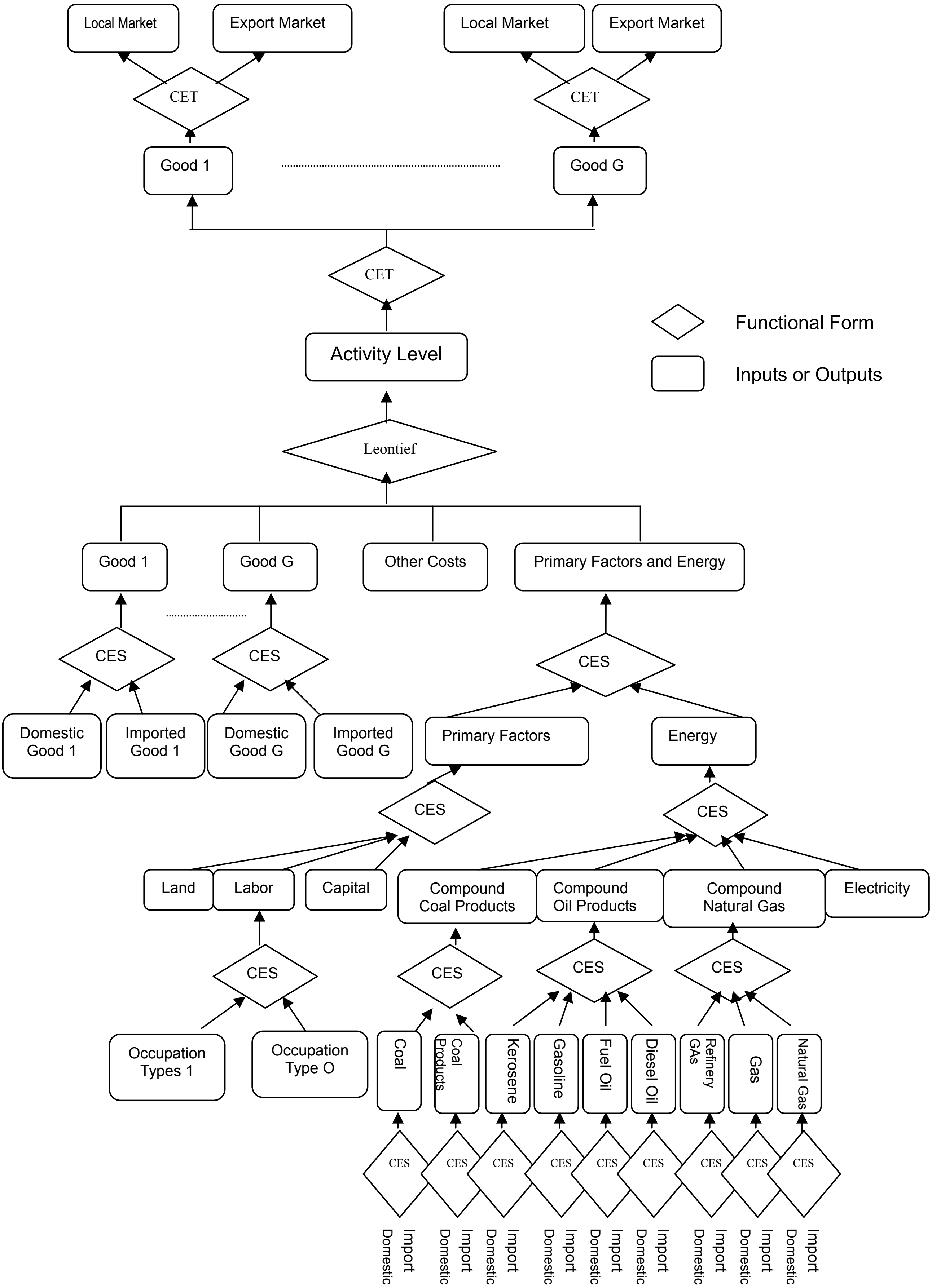


Figure 2. Structure of Production: Non-Electricity Sectors

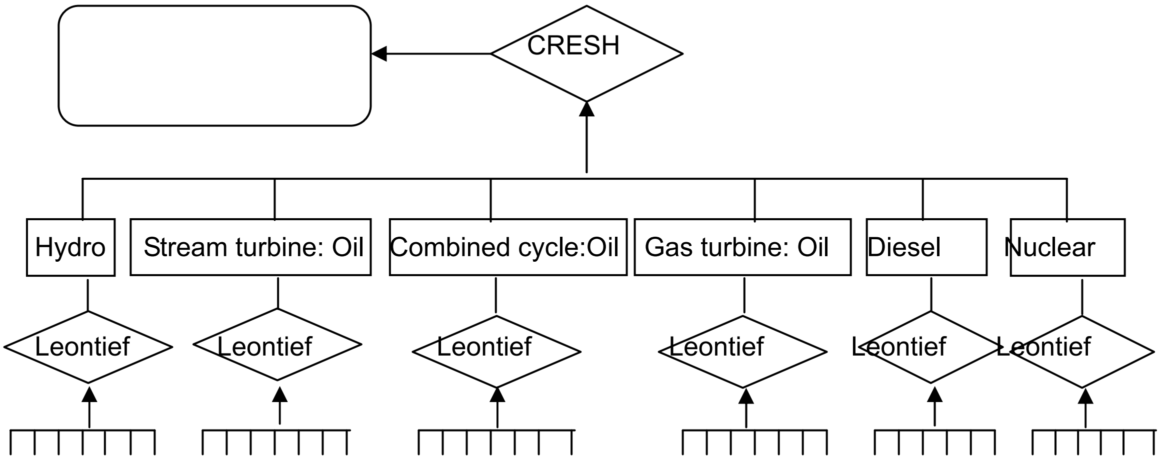


Figure 3. Technology Bundle of TAIGEM-D Model: Electricity Sector

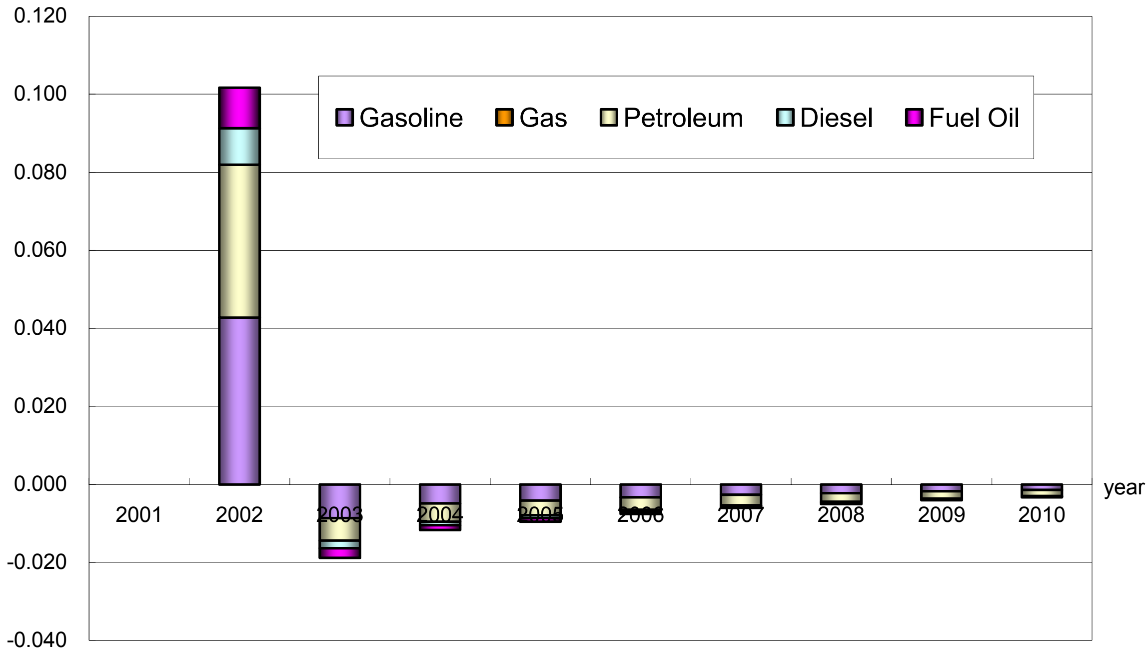


Figure 4 (a). Effect of Tariff Elimination on Real GDP

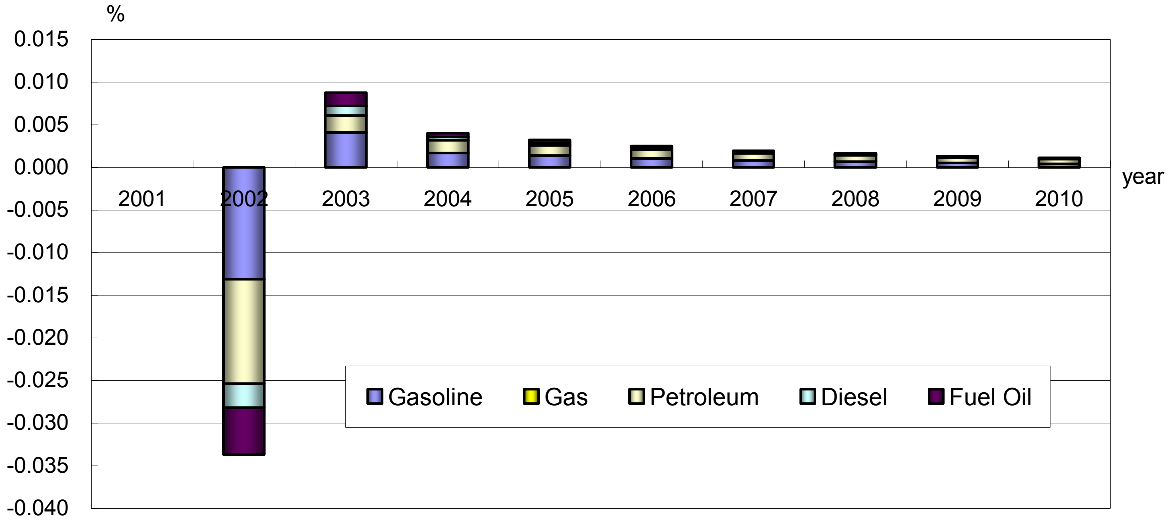


Figure 4(b). Effect of Tariff Elimination on CPI

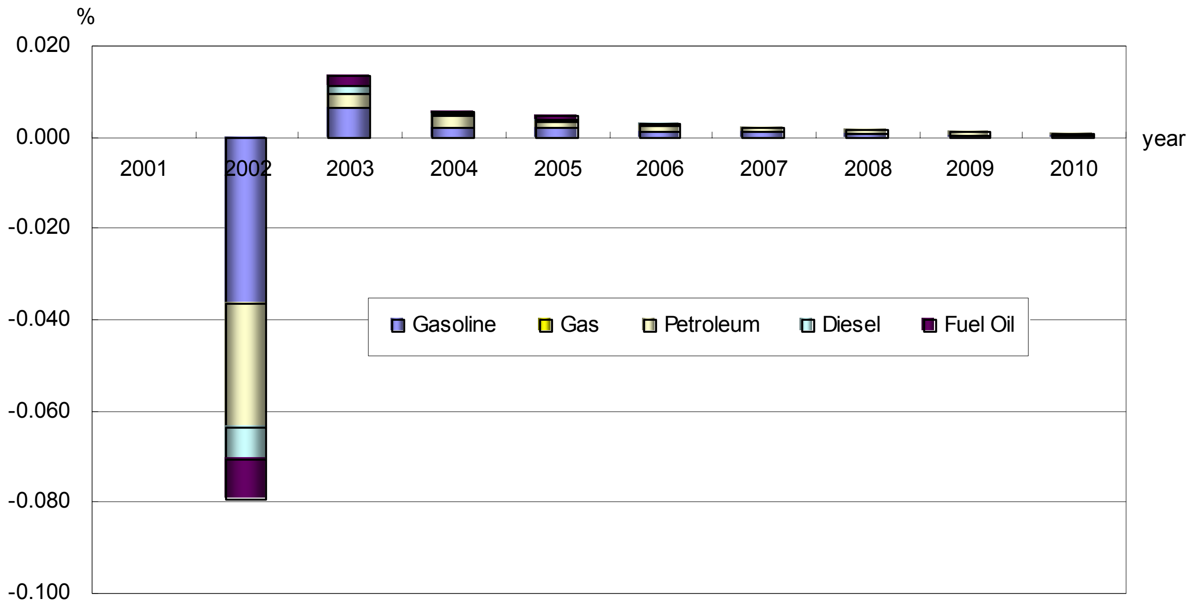


Figure 4(c). Effect of Tariff Elimination on Term of Trade

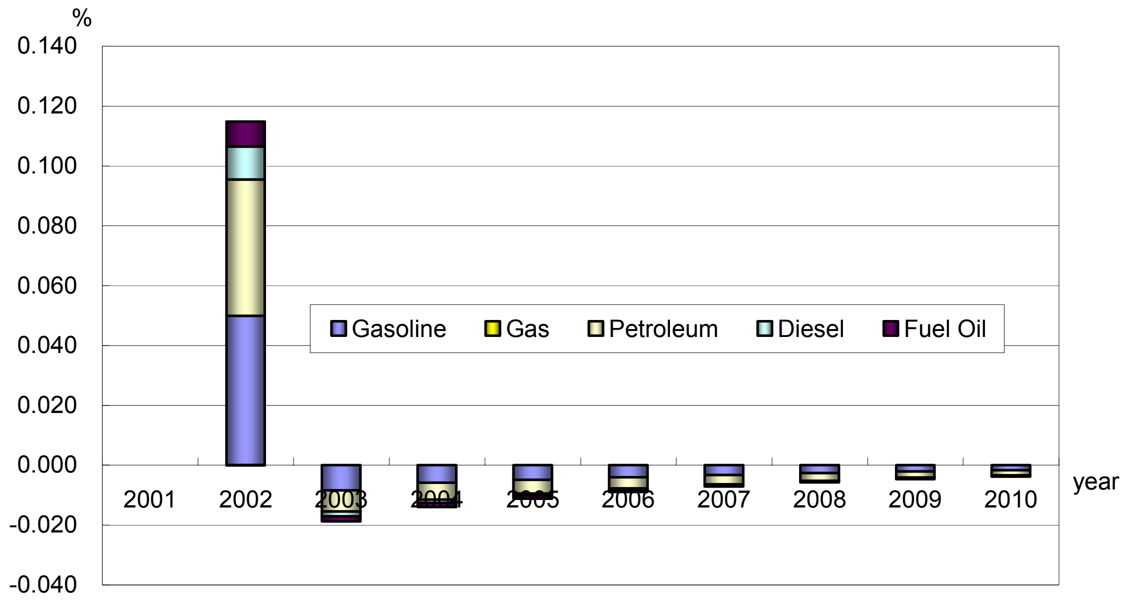


Figure 4(d). Effect of Tariff Elimination on Utility per Capita

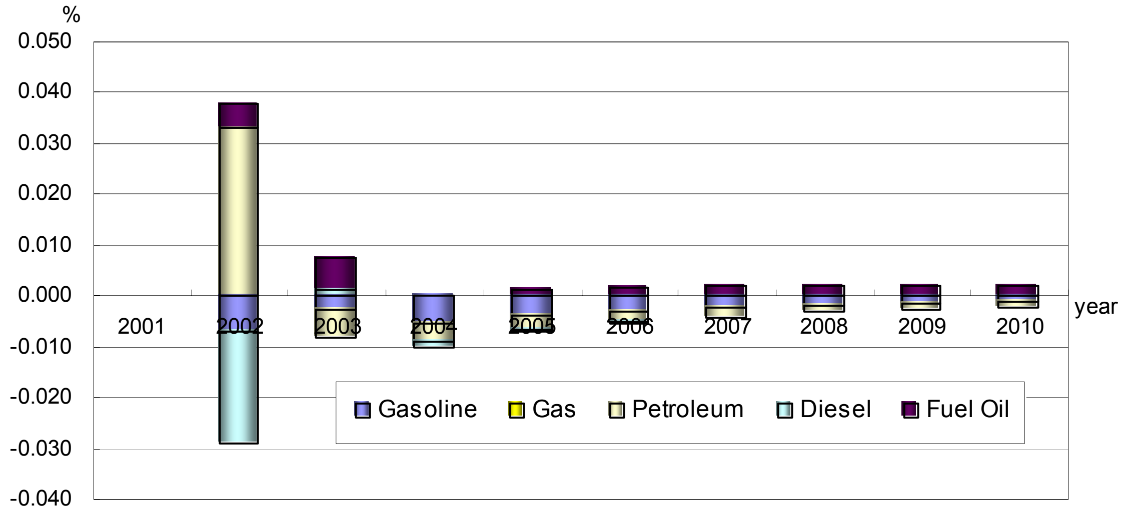


Figure 4(e). Effect of Tariff Elimination on $CO_2$ Emissions

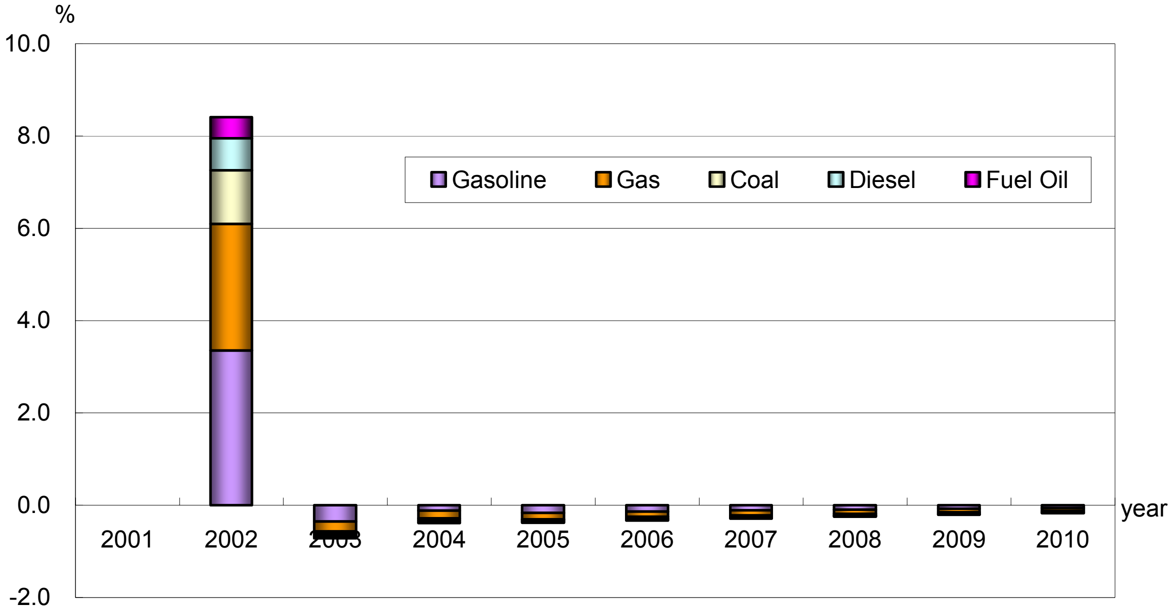


Figure 5(a). Effect of Eliminating Market Structure Distortion on Real GDP

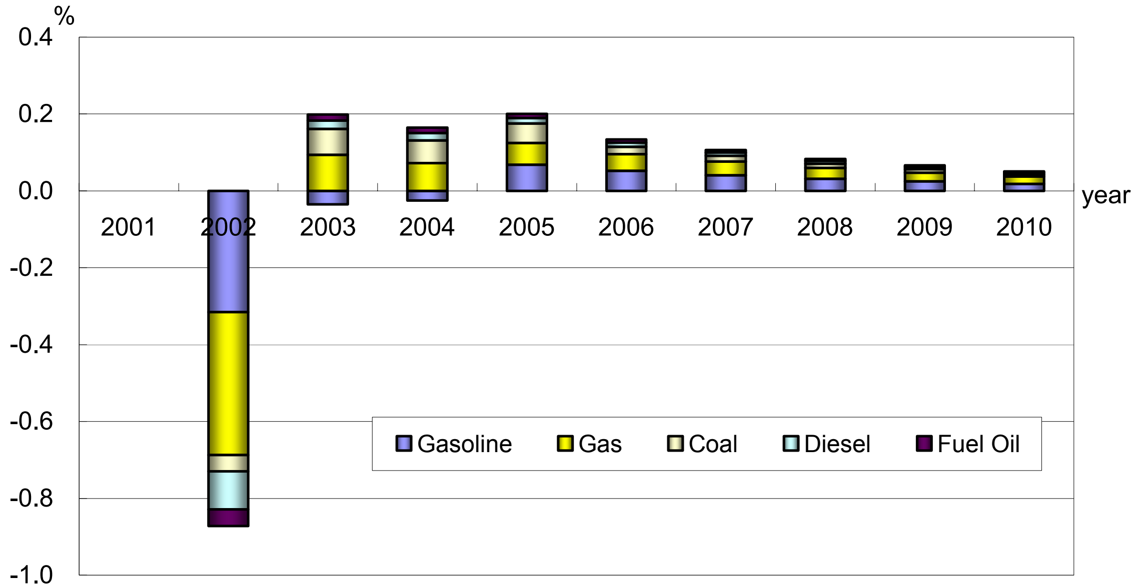


Figure 5(b). Effect of Eliminating Market Structure Distortion on CPI

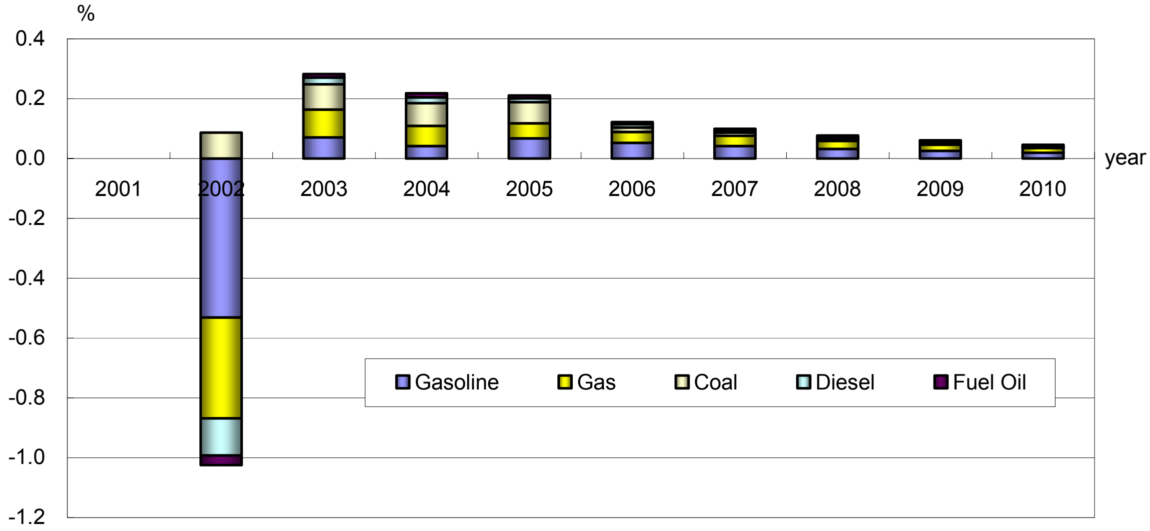


Figure 5(c). Effect of Eliminating Market Structure Distortion on Term of Trade

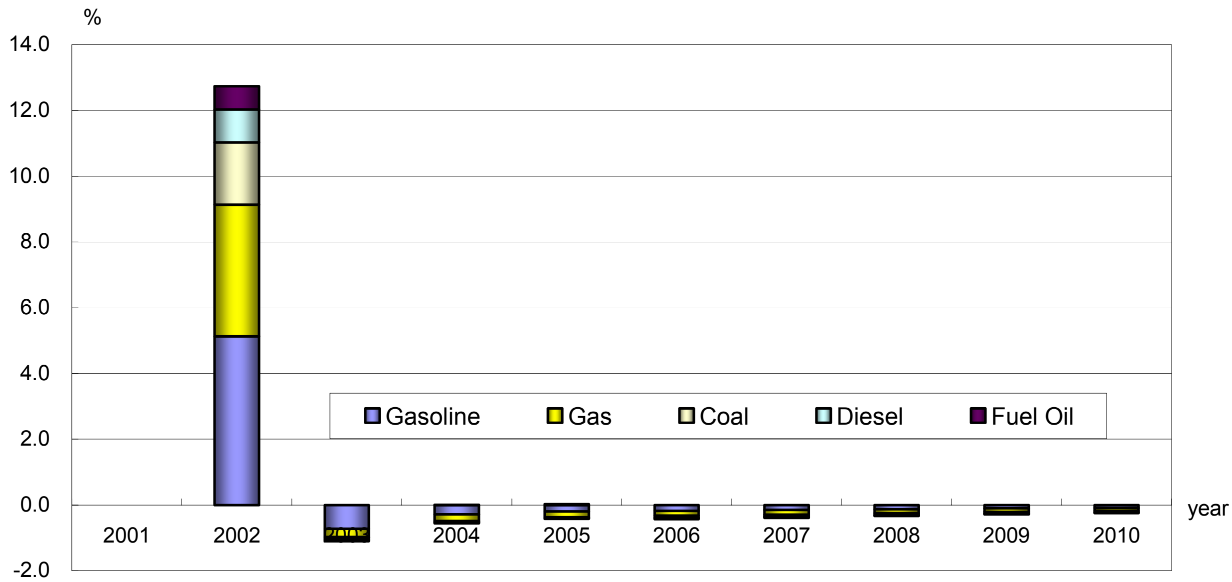


Figure 5(d). Effect of Eliminating Market Structure Distortion on Utility per Capita

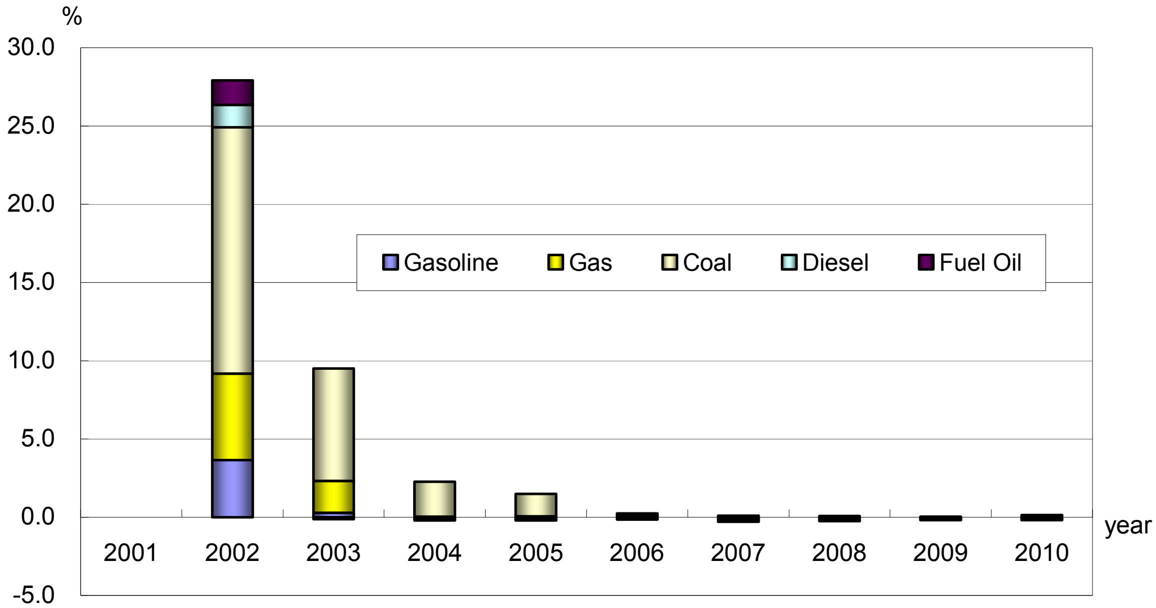


Figure 5(e). Effect of Eliminating Market Structure Distortion on $CO_2$ Emissions

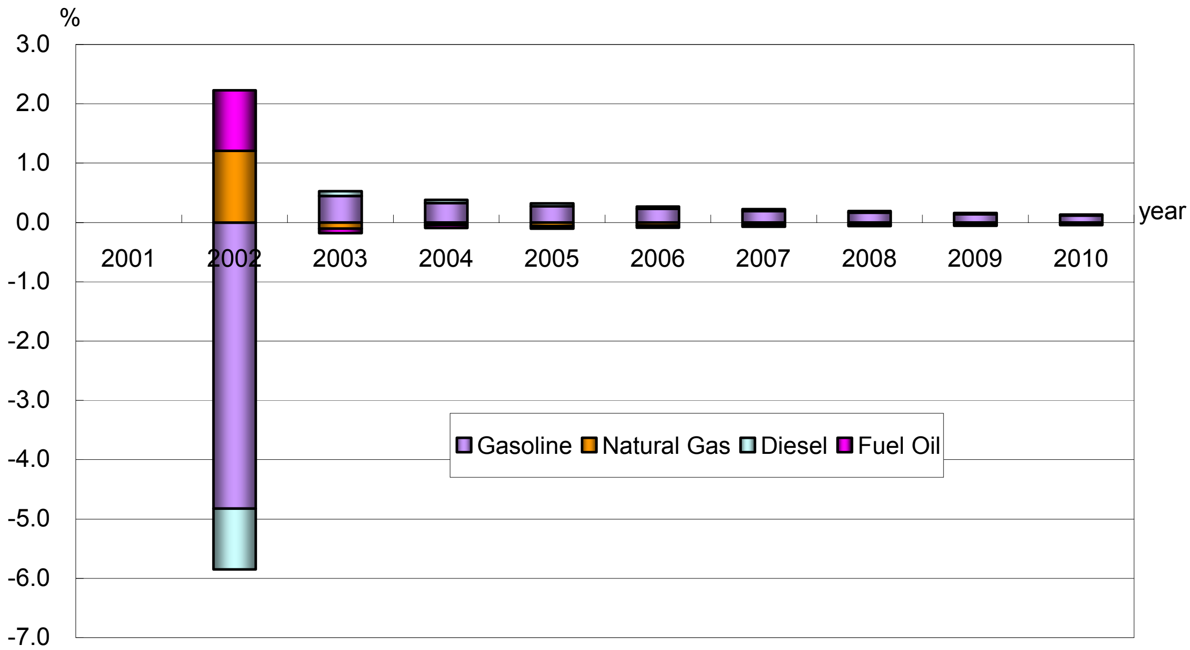


Figure 6(a). Effect of Ramsey Pricing on Real GDP

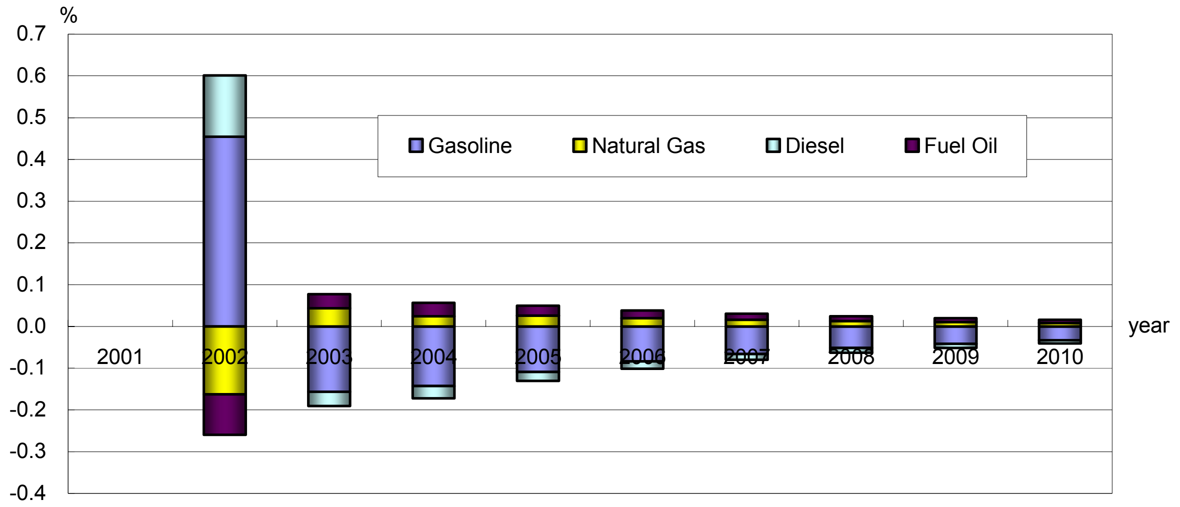


Figure 6(b). Effect of Ramsey Pricing on CPI

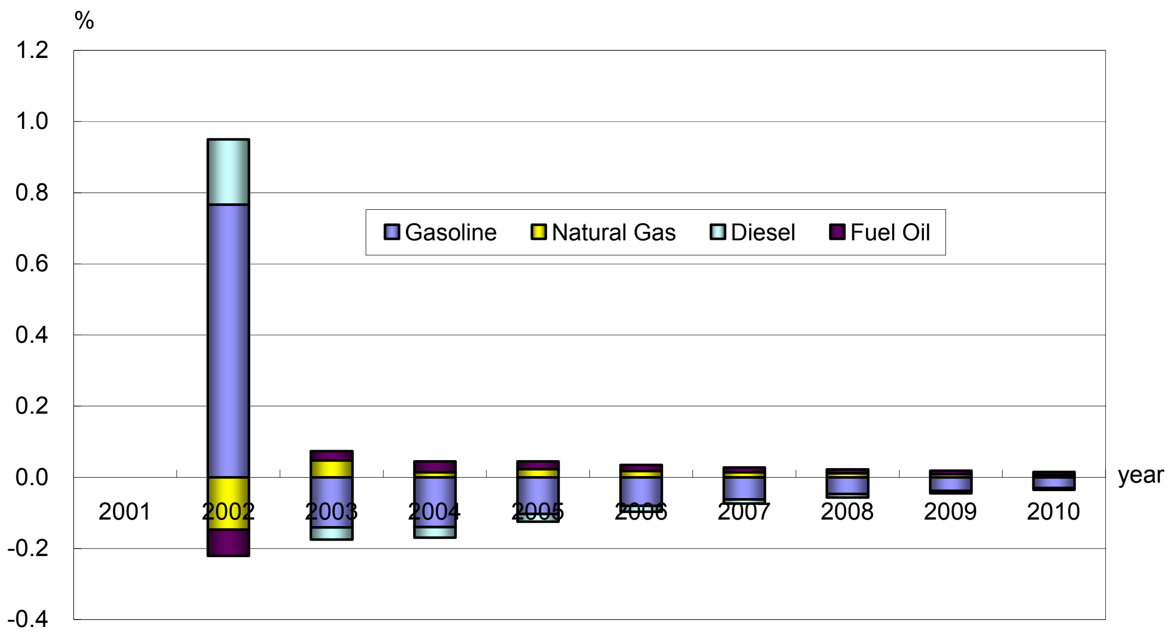


Figure 6(c). Effect of Ramsey Pricing on Term of Trade

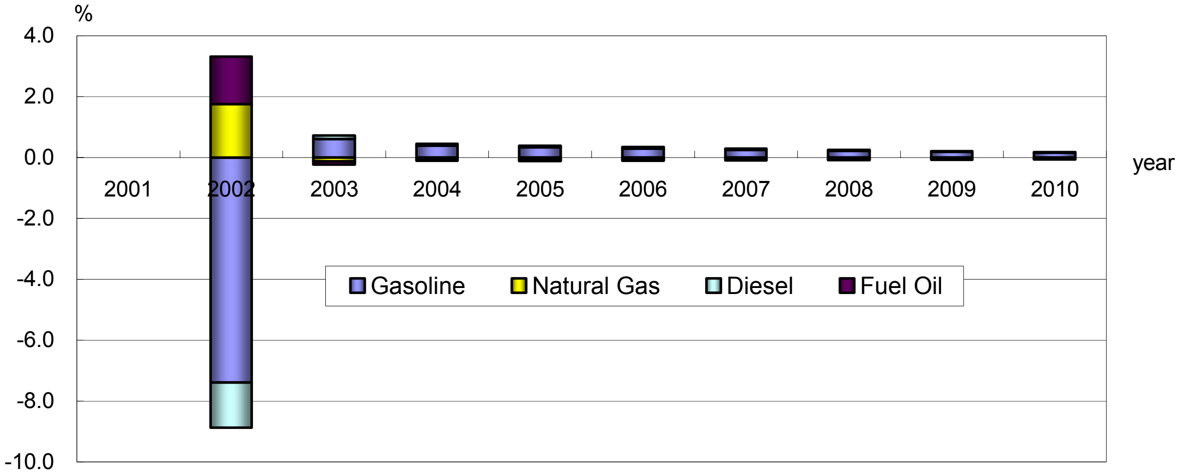


Figure 6(d). Effect of Ramsey Pricing on Utility per Capita

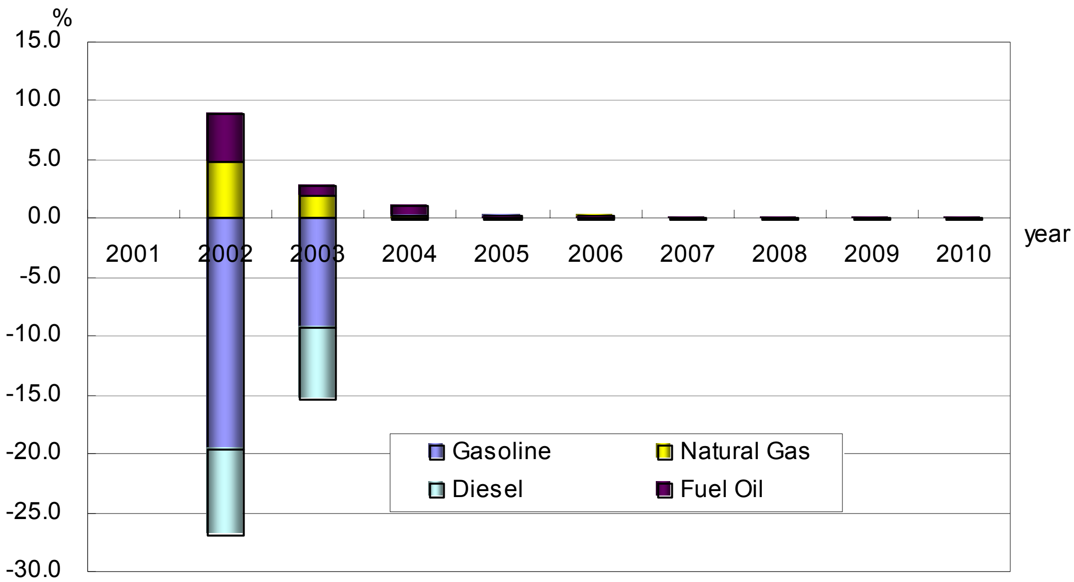


Figure 6(e). Effect of Ramsey Pricing on $CO_2$ Emissions

Table 7. Effect of Ramsey Pricing on industrial sectors

Unit: %

| Impacts on | I | II | III | IV | V | VI | VII | VIII | IX |
|---|---|---|---|---|---|---|---|---|---|
| ***RP for natural gas*** | | | | | | | | | |
| Employment | -0.04 | 4.04 | 0.11 | 0 | 0.06 | 0.02 | -2.12 | 0 | -0.04 |
| Product price | 0 | 0.02 | -0.15 | 0 | -0.07 | -0.04 | -1.31 | 0.02 | 0.01 |
| Value of import | 0.02 | 3.06 | -0.2 | 0.02 | -0.07 | -0.06 | -2.48 | -0.01 | 0.03 |
| Value added | -0.01 | 7.05 | 0.18 | 0.02 | 0.08 | 0.03 | -2.62 | 0.02 | -0.01 |
| Export | 0.17 | 0.18 | 0.3 | 0.02 | 0.16 | 0.18 | 0.18 | 0.18 | 0.18 |
| ***RP for gasoline*** | | | | | | | | | |
| Employment | 0.28 | -0.62 | -0.65 | 0.12 | 0.05 | -0.49 | 1.39 | -0.35 | 0.3 |
| Product price | 0.12 | 0.69 | 0.26 | -0.03 | 0.11 | 0.27 | 0.63 | 0.66 | -0.07 |
| Value of import | -0.08 | -4.69 | -0.23 | -0.18 | 0.19 | 0.02 | 1.47 | 1.22 | -0.1 |
| Value added | 0.07 | -1.04 | -0.96 | -0.05 | -0.13 | -0.63 | 1.41 | -0.53 | 0.12 |
| Export | -1.2 | -1.81 | -0.78 | 0.11 | -0.5 | -1.81 | -1.81 | -1.81 | -1.81 |
| ***RP for diesel*** | | | | | | | | | |
| Employment | -1.74 | 0.01 | -0.35 | 0.16 | 0.01 | -0.49 | 4.93 | -0.29 | 0.28 |
| Product price | 1.68 | 4.18 | 0.07 | -0.06 | 0.22 | 0.57 | 2.65 | 0.86 | -0.11 |
| Value of import | -0.21 | 2.69 | -1.94 | -0.26 | 0.11 | 0.29 | 4.58 | 1.85 | -0.13 |
| Value added | -2.54 | 0.34 | -0.61 | 0.02 | -0.15 | -0.6 | 6.14 | -0.46 | 0.09 |
| Export | -22.55 | -1.37 | -0.45 | 0.18 | -0.34 | -1.37 | -1.37 | -1.37 | -1.37 |
| ***RP for fuel oil*** | | | | | | | | | |
| Employment | -0.02 | -0.59 | 0.25 | 0.02 | 0.11 | 0.07 | -1.51 | 0.03 | -0.05 |
| Product price | 0.01 | -0.01 | -0.1 | -0.01 | -0.06 | -0.02 | -0.84 | 0 | 0 |
| Value of import | 0.06 | -0.66 | 0.65 | 0.03 | -0.04 | 0.03 | -1.43 | 0.07 | -0.01 |
| Value added | 0.01 | -0.61 | 0.31 | 0.03 | 0.11 | 0.08 | -2.23 | 0.06 | -0.02 |
| Export | 0.31 | 0.55 | 0.3 | 0.02 | 0.29 | 0.55 | 0.55 | 0.55 | 0.55 |

I = Agriculture; II = Mineral; III = Basic industry; IV = Technology intensive industry; V = Traditional industry; VI = Construction; VII = Public utilities; VIII = Marketing and services; IX = Other service.

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